ISNAR

Research Report

NUMBER 8

Choosing the Right Trees

Setting Priorities for Multipurpose Tree Improvement

Steven Franzel
Hannah Jaenicke
Willem Janssen

The mandate of the International Service for National Agricultural Research (ISNAR) is to assist developing countries in bringing about lasting improvements in the performance of their national agricultural research systems and organizations. It does this by promoting appropriate agricultural research policies, sustainable research institutions, and improved research management. ISNAR's services to national research are ultimately intended to benefit producers and consumers in developing countries and to safeguard the national environment for future generations.

ISNAR offers developing countries three types of service, supported by research and training:

- For a limited number of countries, ISNAR establishes long-term, comprehensive partnerships to support the development of sustainable national agricultural research systems and institutions.

- For a wider range of countries, ISNAR gives support for strengthening specific policy and management components within the research system or constituent entities.

- For all developing countries, as well as the international development community and other interested parties, ISNAR disseminates knowledge and information about national agricultural research.

ISNAR was established in 1979 by the Consultative Group on International Agricultural Research (CGIAR), on the basis of recommendations from an international task force. IT began operating at its headquarters in The Hague, the Netherlands, on September 1, 1980.

ISNAR is a nonprofit autonomous institute, international in character, and apolitical in its management, staffing, and operations. It is financially supported by a number of the members of the CGIAR, an informal group of donors that includes countries, development banks, international organizations, and foundations. Of the 16 centers in the CGIAR system of international centers, ISNAR is the only one that focuses specifically on institutional development with national agricultural research systems.

ISNAR's Research Report series presents the findings of research conducted by the institute and its partners in the area of agricultural research policy, organization, and management.

isnar

Research Report

NUMBER 8

Choosing the Right Trees

Setting Priorities for Multipurpose Tree Improvement

Steven Franzel
Hannah Jaenicke
Willem Janssen

April 1996

Disclaimer

The findings, interpretations, and conclusions expressed in this paper are entirely those of the authors and should not be attributed in any manner to the International Service for National Agricultural Research and/or the International Center for Research in Agroforestry.

About the Authors

Steven Franzel, Agricultural Economist, Production Systems Program, ICRAF.
Hannah Jaenicke, Tree Physiologist, MPT Improvement Program, ICRAF.
Willem Janssen, Senior Officer, Policy and Systems Design Program, ISNAR.

Citation

Franzel, S., H. Jaenicke and W. Janssen. 1996. Choosing the Right Trees: Setting Priorities for Multipurpose Tree Improvement. ISNAR Research Report No. 8. The Hague: International Service for National Agricultural Research.

AGROVOC Descriptors

Agriculture; forestry; management techniques; research; trees.

CABI Descriptors

Agricultural research; forestry; management; trees.

ISSN 1021-4429
ISBN 92-9118-025-4

CONTENTS

BOXES

FIGURES

TABLES

FOREWORD

Priority setting requires in-depth understanding of user inclinations, problems, technological opportunities and the procedures to make choices. It is therefore best done by combining knowledge of the subject matter with knowledge of the priority setting procedures. The present report is the outcome of such integration. Social and biophysical scientists from ICRAF and the agroforestry programs of West Africa have been collaborating with a priority-setting specialist from ISNAR to develop a feasible approach for selecting the most suitable multi-purpose tree species for improvement purposes. The challenge was certainly daunting. Data availability on the many multipurpose tree species of West Africa is extremely limited. The distribution and volume of production of fruit or timber, for example, from many of the species are not known. Estimating the value of different species is further complicated by the fact that they may have several applications, with the principal use changing from zone to zone. Marketing of the multiple products of these species is not documented.

The poor knowledge base on multipurpose trees makes estimation of the possible effects of research efforts more difficult than for agricultural commodities. The large number of possible species and the paucity of information on these species necessitated the design of a priority-setting process radically different from traditional scoring or economic surplus approaches. The process combines secondary information, expert opinion and targeted information collection in a stepwise process. In this process the number of species is gradually reduced and the amount of information per species that is used to make the decisions is gradually increased. At each stage, the authors have tried to maximize reliability and methodological rigor while minimizing time and costs. At the end, an approximation of the expected value of research is obtained.

For ISNAR, the present report presents a step forward in mastering the procedural aspects of priority setting. Often, designing priority-setting procedures is as critical as choosing the exact priority-setting method.

For ICRAF, the present report is a step forward in systematically defining research to improve agroforestry systems. Whereas the benefits of agroforestry are intuitively obvious, the present report provides a procedure for deciding for which species these benefits are likely to be highest.

The authors hope that the present report will stimulate other research organizations to better target their involvement in agroforestry research, natural resource management research or agricultural research. Though the guidelines in this report have been specifically developed for multipurpose trees, they can be applied with minor modifications in other fields such as selection of horticultural crops or assisting in choosing commodities for diversification.

The guidelines are currently being implemented in various ecozones or countries, for example the semi-arid lowlands of West Africa, and Peru and Mexico in South America.

Christian Bonte-Friedheim
Director General
ISNAR

Pedro Sanchez
Director General
ICRAF

March 1996

ACKNOWLEDGMENTS

We are grateful to the following people for their assistance in the design of the priority setting procedures and their implementation in West Africa: A.O. Adeola, I.O.O. Aiyelaagbe, K. Appiagyei-Nkyi, Elias Ayuk, S.Y. Bennuah, Douglas Boland, Bahiru Duguma, E.L. Jampoh, J. Kengue, Popoola Labode, David Lapido, Matthias Molet, Lina Muturi, K. Obisesan, K. Okunomo, Fred Owino, J. Owusu, S.J. Quashi-Sam, T. Tiki-Manga, Z. Tchoundjeu, and Pauline Zenkeng. We are grateful to Bahiru Duguma, Frank Place, Anthony Simons, and three anonymous referees for their comments on earlier versions of this report. We also express our gratitude to Judy Kahn for editing the manuscript and to Melina Tensen for her support in preparing the final draft.

Steven Franzel
Hannah Jaenicke
Willem Janssen

ABSTRACT

Setting priorities among tree species for genetic improvement research, involves an integration of researchers' and farmers' perspectives for choosing those species that will give the greatest benefits. The process requires both socioeconomic and biophysical expertise and begins with an assessment of users', that is resource-poor farmers', needs. Researchers conduct region-wide surveys to determine farmers' preferences among species and, at meetings, assess candidate species according to their researchability, expected adoption, and policy objectives. Once a short list of a few (e.g. 4 to 6) species is drawn up from the above exercises, researchers conduct field surveys to estimate the value of the tree products from these species and validate and rank the species. This prioritization procedure is flexible; it can be adapted to meet the specific needs of the researchers.

To set priorities for research is no new task. However, the procedures presented in this document are innovative; they are structured and objective, and involve both researchers and farmers. The procedures have been tested in the humid lowlands of West Africa (HULWA) and are being further refined in other areas.

ABREGE

L'établissement de priorités parmi les différentes espèces d'arbres, dans le contexte des recherches visant l'amélioration du matériel génétique, implique l'intégration de la perspective de la recherche et de celle des agriculteurs de façon à choisir les espèces qui donneront les meilleurs résultats. C'est un processus qui fait appel à une expertise à la fois socioéconomique et biophysique et qui repose sur l'évaluation des besoins des utilisateurs, c'est-à-dire des paysans pauvres. Les chercheurs mènent des enquêtes au niveau de la région pour déterminer quelles sont les espèces préférées des paysans, puis ils se réunissent en atelier pour évaluer les espèces retenues des points de vue de leur aptitude à se prêter à la recherche et de leur probabilité d'adoption, et par rapport aux objectifs politiques. Après avoir établi une liste pré-finale, comprenant entre 4 et 6 espèces, les chercheurs retournent mener des enquêtes sur le terrain pour estimer la valeur des produits de ces espèces ; ils valorisent enfin les résultats obtenus et classent les espèces. La procédure permet une certaine flexibilité d'action et peut être adaptée en fonction des besoins spécifiques des chercheurs.

Si l'établissement de priorités n'est pas en soi une activité nouvelle, les procédures décrites dans le présent document sont innovatrices ; elles ont une structure et sont objectives et impliquent une participation à la fois des chercheurs et des agriculteurs. Elles ont été validées sur le terrain dans les vallées humides de l'Afrique de l'Ouest et des travaux sont en cours dans d'autres régions pour les affiner davantage encore.

RESUMEN

El establecimiento de prioridades entre especies de arboles para la investigación dirigida al mejoramiento genético, concierne una integración de las perspectivas de los investigadores y los agricultores para elegir las especies que darán los mejores beneficios. El proceso requiere de habilidad socioeconómica así como biofísica y empieza con un asesoramiento de los requerimientos de los usuarios, o sea los agricultores de escasos recursos. Los investiga-

dores hacen estudios regionales para determinar las preferencias de los agricultores en cuanto a las especies y, durante reuniones, asesoran en relación a las especies candidatas según su capacidad para ser investigada, su adopción esperada y sus objetivos de política. Una vez hecha una lista de, por ejemplo, 4 o 6 especies, usando los ejercicios mencionados, los investigadores conducen estudios en el campo para validar, clasificar y estimar el valor de los productos arboríficos de estas especies. Este procedimiento de priorización es flexible; puede ser adaptado para satisfacer a las demandas específicas de los investigadores.

Establecer prioridades para la investigación agrícola no es una novedad. Pero, los procedimientos presentados en este documento son inovativos; son estructurados y objetivos e involucran a investigadores así como agricultores. Los procedimientos han sido probados en zonas bajas húmedas del oeste de África (HULWA) y se encuentran en un mayor refinamiento.

ACRONYMS

GIS	geographical information system
HULWA	Humid Lowlands of West Africa
IARC	international agricultural research center
ICRAF	International Center for Research in Agroforestry
ISNAR	International Service for National Agricultural Research
MPT	multipurpose tree
NARS	national agricultural research system
RGS	relative gain score
SULWA	Semi-arid Lowlands of West Africa

EXECUTIVE SUMMARY

This report presents guidelines for the setting of priorities among multipurpose tree (MPT) species for genetic improvement research in an ecozone. It draws on experience gained during species prioritization exercises in the humid lowlands of West Africa (HULWA), the semi-arid lowlands of West Africa (SALWA), and Peru from 1993 to 1995, exercises jointly undertaken by staff of the International Center for Research in Agroforestry (ICRAF), the International Service for National Agricultural Research (ISNAR), and National Agricultural Research Systems (NARS) in the respective regions.

In the past, researchers' own interests and views on the importance of different trees were probably the most important criteria in setting research priorities among species. The methods presented in this document, on the other hand, provide reasonably objective and systematic procedures to deal with a broad range of issues and arrive at the best possible set of research activities. They encourage the participation and integrate the views and expertise of the various stakeholders involved in the process — clients (e.g., resource-poor rural households), scientists of national and international agricultural research institutions, and policymakers.

The objective of MPT species prioritization is to determine the species for which improvement research would have the highest impact. Impact is defined as an increase in financial value and may be modified by other non-financial objectives, such as improving the welfare of women.

Priority setting for multipurpose trees is severely constrained by the poor data availability. In consequence, a procedure has been developed which builds on widely and easily available information to make initial screenings and which gradually collects and develops more specific information to make the final decisions. The procedure aims to approximate the expected value of research on multipurpose tree species, but does so only for a limited number of species that have passed through the initial screenings. Information constraints are a common problem in priority-setting exercises, especially for Natural Resource Management research, and we hope that the present example will prove a useful approach for other priority-setting exercises with limited information.

The priority-setting process involves several steps; with each step, the number of species considered is reduced, in order to focus data collection on a limited number of species at the following step:

1. **Team building and planning**. This involves building an effective team among the participants from the different institutions and developing a consensus on the application of the priority-setting approach and the modifications that may be required.
2. **Assessment of client needs**. A review of secondary information is needed to define user groups, and identify their main problems and the agroforestry products that may best meet their needs.
3. **Assessment of species used by clients**. Semi-structured field surveys are often used in which farmers list the MPT species they grow and use, and rank them according to their preferences.

4. **Ranking of products**. Tree products and services are ranked in order of their potential importance for solving the present and future problems of the clients. Only the species that provide the most important products are considered in the following stages.
5. **Identification of a limited number (e.g. four to six) priority species**. Researchers refine the list further by ranking species on their researchability (the potential of research to achieve impact in improving the species), expected rates of adoption, and non-financial factors that modify the objective of increasing financial value.
6. **Valuation and ranking of priority species**. Detailed data are collected from farmers and markets to estimate the value of products of the remaining species and to update the information on researchability, expected adoption, and modifiers.
7. **Final choice**. Here, the results of the exercise are synthesized in a workshop and the choice of priority species is approved.

The set of procedures is flexible, it can easily be adapted to meet the particular needs of researchers in different circumstances. Moreover, it provides numerous benefits in addition to setting priorities among species. In HULWA, for example, a great deal of useful information for developing a genetic improvement program was assembled about the region, its farmers, and MPT species. The exercise was also important for improving linkages among IARCs and NARS, building a spirit of collaboration, and facilitating rapid progress in germplasm collection and propagation studies. In addition, the development of procedures for choosing research topics has contributed to stronger relations with donors and policymakers.

1. Introduction

Priority setting in agricultural research has received considerable attention over the last decade, especially concerning the possible methods that can be applied (van Oppen and Ryan, 1985; Contant and Bottomley, 1988; Alston et al., 1995; Kelly et al., 1995). The basic idea behind setting research priorities is that the amount of available resources does not allow scientists to conduct research on all possible opportunities. The objective of MPT species prioritization is to determine the species for which improvement research would likely have the highest impact. Impact, in turn, needs to be defined in terms of specific objectives, which may include increasing incomes and welfare of resource-poor farmers, improving the environment, and improving the welfare of women.

In classical plantation forestry, the selection of species for improvement is usually not a major challenge. The identification of species is usually predetermined; an economically important species which is already grown in plantations requires further genetic improvement. Such improvement may take different forms and only a few will be mentioned here. The most productive or highest quality provenances may be selected from germplasm collections for multiplication and distribution across production systems. Highly specific problems would be solved by complementary plant breeding programs. Tree management could be optimized, or the marketing of the tree products researched and modified. Alternatively, if the species is not known, the end-product usually is and the need then is simply to determine the most appropriate species to use, through a set series of species elimination, testing and proving trials (Burley and Wood, 1977). After this process is complete, the genetic improvement of the selected species can commence. In both of these examples the client is usually a government department or a commercial forestry company, and both have close control over the genetic improvement and adoption process.

In agroforestry, in contrast, the choice of species is much more complex in both socioeconomic and biophysical terms. The clientele is very heterogeneous. It consists of many individual small-scale farmers with differing needs which are difficult to generalize across an ecozone. Farmers use many different tree species, and little scientific information is available about most of them. Moreover, farmers may use a single species in several ways. The products[1] they provide may be very important but difficult to value because they are not frequently marketed (e.g., firewood) or because they are difficult to quantify (e.g., soil erosion control).

Farmers grow a diverse range of multipurpose tree species; research efforts to maintain this diversity score high on the agenda of agroforestry research. If the possible benefits from agroforestry practices are increased, their diffusion may widen, and sustainability of agricultural production may be enhanced. For this purpose, it is essential to improve the productivity of the main component of the agroforestry practice, the multipurpose tree.

In setting research priorities among species in the past, researchers' own interests and views on species importance were probably the most important criteria. The priority-setting procedure presented in this document, on the other hand, provides a reasonably objective and systematic method to deal with a broad range of issues and arrive at the best possible set

1 The term *product* includes materials, e.g., fruits or timber, and services, e.g., soil erosion control or shade.

of research activities. It encourages the participation and integrate the views and expertise of the various stakeholders involved in the process across an ecozone: clients (e.g., farm households), scientists of research institutions (e.g., NARS and international agricultural research centers [IARCs]) and policymakers. Normally, prioritization methods do not entail a complete assessment of the possible benefits and costs of a particular research opportunity. Rather, they focus on the key factors that define or estimate the expected benefits and costs. In this way, considerable time and resources can be saved though this may often entail a certain cost in terms of precision. There is no guarantee that the right species will be chosen; but the process helps to reduce the chance of choosing less important species.

This document presents guidelines for the setting of priorities among multipurpose tree (MPT) species for genetic improvement research in an ecozone.[2] It draws on experience gained during species prioritization exercises in the humid lowlands of West Africa (HULWA) from 1993 to 1995, exercises jointly undertaken by staff of the International Center for Research in Agroforestry (ICRAF), the International Service for National Agricultural Research (ISNAR), and National Agricultural Research Systems (NARS) in the region (Jaenicke et al., 1995; Adeola et al., 1994).

The objectives of this document are to

- examine the issues that should be considered in priority setting for MPT species and assemble them in a conceptual framework;
- present a systematic, but flexible, stepwise procedure for determining priority MPT species for genetic improvement research;
- introduce specific data collection instruments useful in the priority-setting procedure and explain their function and application.

The guidelines presented here are flexible and not a "recipe book". The readers will need to modify and refine them to ensure their appropriateness to their particular circumstances.

2 An ecozone is an area with relatively uniform environmental conditions. It may encompass parts of several countries. For example, HULWA includes parts of 11 countries in West Africa with altitudes below 1000 m, annual rainfall over 1500 mm, and growing periods over 220 days per year.

2. Factors to Consider When Preparing Priority-Setting Procedures

A priority-setting procedure should take account of

- the overall objectives of conducting the research;
- the various stakeholders;
- the large number of possible activities (opportunities);
- the information sources;
- the widely different types of benefits that can be obtained.

Research Objectives

Research priorities can be effectively determined only when the objectives of the research program are clearly defined and agreed upon by the research teams. The co-ordinating research institution needs to determine whether its mandate is only to contribute to economic growth, or if other concerns such as income distribution, gender, or improved management of natural resources also play a role in determining its focus.[3] Research may have an impact on many different aspects of socioeconomic and ecological performance, and these desired impacts should be clearly documented. The relative importance of the different objectives should be known in order to evaluate research opportunities which contribute to different objectives. Very often it is difficult for policymakers or research managers to define the exact relative importance of different research objectives. Thus, for priority setting in a systematic manner, it may be necessary to make certain assumptions about the relative importance of different objectives.

As explained in Chapter 3, in the present exercise we have adopted the objective of increasing the value of multipurpose tree production through research. The proposed priority setting procedure therefore tries to estimate the potential value of research, focusing on monetary value. In addition it may be necessary to consider additional objectives, but we also realize it may be necessary to consider additional objectives, such as equity, gender or sustainability. In the proposed procedure, the expected monetary value of research is therefore modified in order to account for these other objectives.

Stakeholders

Two other issues further complicate the definition of research objectives. Firstly, research is normally targeted towards possible groups of beneficiaries, such as farmers or low-income households. The beneficiaries are normally not the people who conduct the research; it is however necessary to bring their perspective into the priority-setting process.

---

3 The present guidelines were developed with the objective of increasing the value of the products and services supplied by multipurpose tree species. For objectives not involving economic value, such as genetic conservation, a different exercise would be needed to set priorities among species. For example, in genetic conservation, the exercise would be likely target species in danger of extinction, whereas for product value, species that are widely grown would appear to be better targets.

Secondly, research is rarely conducted by a single, isolated institution or program, but almost always in collaboration with partner institutions and programs. The objectives of these partners should be considered for planning and prioritizing research. Priorities should be set in consultation with all the partners involved with (agro) forestry research in the NARS, thus strengthening the collaborative process and improving the quality and usefulness of the research.

The user perspective has been central to the development of the proposed procedure. Rather than commencing with an inventory of research alternatives, the procedure starts with an inventory of the clientele of this research. Farmer surveys are an important method for defining user groups (that is, groups of farmers with similar circumstances) and determining what types of research benefits they would most appreciate (McDicken and Mehl, 1990). Only then can we make an inventory of the species that may provide the products needed (Figure 2.1).

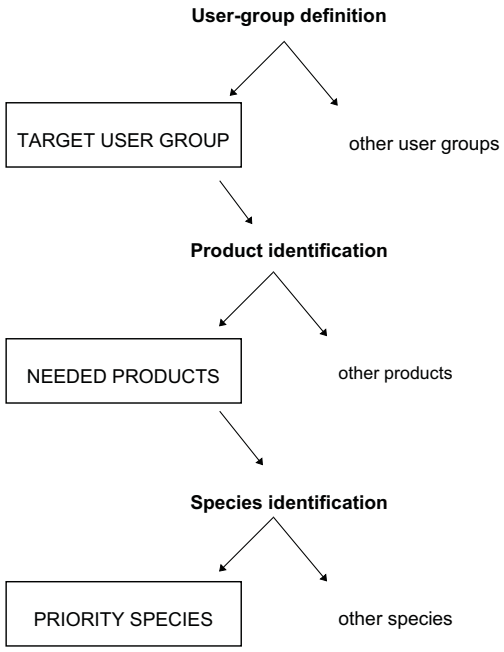


Figure 2.1: Decision-making process for selecting species (after Raintree, 1991)

To integrate all interested institutions and researchers, team building is explicitly included in the priority-setting procedure. The roles of biological and social scientists have been outlined and the technical leadership of the exercise for the different steps of the procedure has also been defined.

Research Opportunities

For MPT improvement research, each possible species represents a different research opportunity. The number of MPT species that can be considered in any given ecozone is very high. For example, in HULWA, more than one hundred species can be defined as possibly relevant for farmers; only few can be selected for improvement research. The high numbers require a rough, rapid, logical and consistent procedure to reduce the large number of species to a small group. At the same time, precision and detail are ultimately required to choose the final one or two species with confidence.

Since it is not cost effective to collect information on all these species, we have used the user-perspective and the demand for MPT products as tools to reduce the large number of species to a more manageable number. We hope that the proposed procedure combines logic, efficiency and precision in an acceptable manner.

Information Sources

In order to determine which tree species may benefit most from research, it is important to understand their present distribution, production, amenability to research and suitability to the targeted farming systems. Many of these species have not yet received formal attention within agricultural research, thus little is known about them. The large number of species makes it impracticable to upgrade the complete information base within the framework of the prioritization exercise.

The priority-setting procedure should make the best possible use of the available information sources for all the alternative species, and a literature review is the logical starting point. Important information sources are, for example, the "Diagnosis and Design" reports issued by the national programs and ICRAF; ethnobotanical surveys; surveys of land use systems; and computerized databases such as the MPT species database (von Carlowitz et al., 1991). Surveys are especially important for defining user groups in an ecozone and collecting information on each group's priorities and problems. If survey reports are not available, it may be necessary to conduct surveys as a prerequisite for conducting a species prioritization exercise.

Maximizing the value of existing information has been central to the development of the procedure presented here, and forms the foundation of the stepwise procedure in which additional information is collected at different stages. The initial steps are based on simple but relevant information. At later stages, when the number of species is smaller, more information can be collected and more precise judgments can be made.

Expected Benefits

The tree species being evaluated may produce different products and services, such as food, medicines, fodder, erosion control or shade. Normally a tree species provides some of these products but not all, and the improvement of the tree species may be directed towards any one of them. In assessing the potential impact of improving different species, the benefits of the different products should be comparable. This requires the valuation of the various pos-

sible products; monetary value is the common denominator by which different products are compared. To compare species across products, new criteria have to be defined and the species scored against these. For example, a species for fodder can be compared with one for soil fertility by comparing their potential contributions to farmers' incomes (Hoekstra and Darnhofer, 1993). For certain products (stakes, poles, fruits, firewood), the valuation may be based on market prices; for others, valuation should be based on indirect criteria: e.g., in case of soil nutrient enrichment, the opportunity cost of fertilizer could be calculated. Valuation is a difficult exercise and may appear somewhat arbitrary especially for products with poorly functioning markets. It is important that all relevant considerations are included in the valuation process. Nevertheless, we feel that the estimation of the expected value of research, however limited, provides the best yardstick for judging the suitability for the improvement of the different MPT species.

Social Versus Private Benefits

The natural resource management dimension of research on MPT species brings an additional complication to the process of priority setting. The benefits of an improved tree species may not accrue to the farmer who plants the improved variety. For example, in the case of a tree species that is suitable for erosion control, the up-hill farmer does not obtain any benefits from the reduction in down-hill river sedimentation that this may cause. Or, because of the time it takes for certain improvements to be appreciated, farmers may not value them. Some of these improvements include nutrient recycling from deeper soil layers, or improved water retention. If these "natural resource management products" are not appreciated by farmers, benefits from a researcher's perspective (a societal perspective) differ from the farmers' perspective (a private perspective). The participants in the priority-setting process need to decide to which degree the societal or the private benefits should guide the priority-setting process.

Agroforestry research is often undertaken because it may contribute to the sustainability of agricultural production systems. In this situation, and when research is publicly funded, the societal perspective will most probably be the one that is adopted.

If research were to be funded by farmers themselves, a private perspective with less attention to natural resource management issues such as erosion might be adopted. Nevertheless, the awareness of farmers on how degradation processes affect their farming possibilities should not be underestimated. When farmers are expecting their families to be able to live off the farming system for a long time to come, private and societal perspective may, in fact, not differ greatly.

A warning should be voiced against research opportunities that would present societal benefits to the practical exclusion of all else. If there are no private benefits, the incentive for farmers to adopt the improved species is small and the final impact of research will be affected by the lack of adoption.

In the proposed procedure, both societal and private perspectives can be adopted. For the humid areas of West Africa, where the procedure was tested, fruit production was the principal benefit of multipurpose trees. The private and societal perspectives were largely coincided.

Model for Estimating Benefits

Where values are too difficult to estimate, criteria which serve as proxies for values may be defined, and the species scored against them. The equation below is a simplified formula for calculating the expected benefits from an improvement program, expressed as an annual value for a year in the future.

Value of expected benefits from improvement	=	Annual value of products per year (1)	x	% increase in value expected from improvement (2)	x	% expected adoption (3)	x	Other non-financial factors (modifiers) (4)

The benefits are a function of (1) the present annual value of the products of the species; (2) its researchability (that is, the potential of research to achieve impact in improving the species), expressed as a percentage annual increase in value; (3) the percent expected adoption of the improved species; and (4) other non-financial factors (also called modifiers), such as the benefits accruing to women, or an improvement in equity. These may be expressed as a factor greater than 1 for beneficial factors, or less than 1 for detrimental ones. The components of the equation are discussed in greater detail in step 5.[4] For example, the products of a given tree species may have a value of 100 million dollars per year and the potential of research to improve this may be 10%. The expected adoption may be such that only 50% of this value is realized. The positive effect that the species has on female incomes may lead us to add a premium of 10% to the monetary value. The total expected benefits from improvement are thus 5.5 million dollars.

In most cases, it is very difficult to quantify expected benefits. Nevertheless, it is important to keep the elements of the equation in mind during the prioritization process and, where necessary, to define proxies for value. For example, researchability (component 2) is a function of the degree of genetic variability, the basic knowledge available concerning the biology of the species, and other factors. Species can be compared across these criteria to determine which one has the greatest expected benefits from improvement.

Though there are certainly cases where it may be necessary to modify or even deviate from the model, the use of such a model and formula will normally lead to logical and acceptable results. In the final step of the priority-setting procedure, we rank the species on their expected value of research. But there are certainly cases where it may be necessary to modify the model or even deviate from it. In assessing for which species the expected value of research is highest, a few points should be taken into account.

Firstly, the priority-setting approach outlined in this report builds on farmers' indigenous knowledge of tree production, utilization and the existing value of tree products. But if this knowledge is lacking (as it may be where most inhabitants are recent migrants into an area, or where trees are not normally grown) then researchers will have to rely more on their own judgment and on additional surveys to determine which species are selected for improvement.

4 Equation largely follows the benefit estimation as developed by Collin and Kissi (1994).

Secondly, if there are strong indications that present trends in the use and value of tree products will change radically, then there is no point in basing decisions solely on the knowledge of present conditions. For example, if there is a feeling that a tree not currently used by farmers will be widely adopted in the near future, this information should be integrated into the assessment of its expected value of production. Whereas this could be done in a formal manner (e.g., by explicitly calculating expected values of production for all species in ten years time), in certain cases the priority-setting team may decide (for good reasons) that a certain species is a very good candidate for improvement despite its present low value.

Models, judgment, and vision are not mutually exclusive. By combining them, arguments are strengthened and research decisions improved. Using a priority-setting model or formula is not a substitute for judgment and vision — it enhances it.

3. The Priority-Setting Procedure

The problems of team building, information sources and the number of candidate species for research have largely defined the priority-setting procedure which is exposed here. The initial screening of species should be based on a minimum of information that can be easily assembled for all species. Only when the number of species under consideration has already been sharply reduced, can a more comprehensive data set for the remaining species be built.

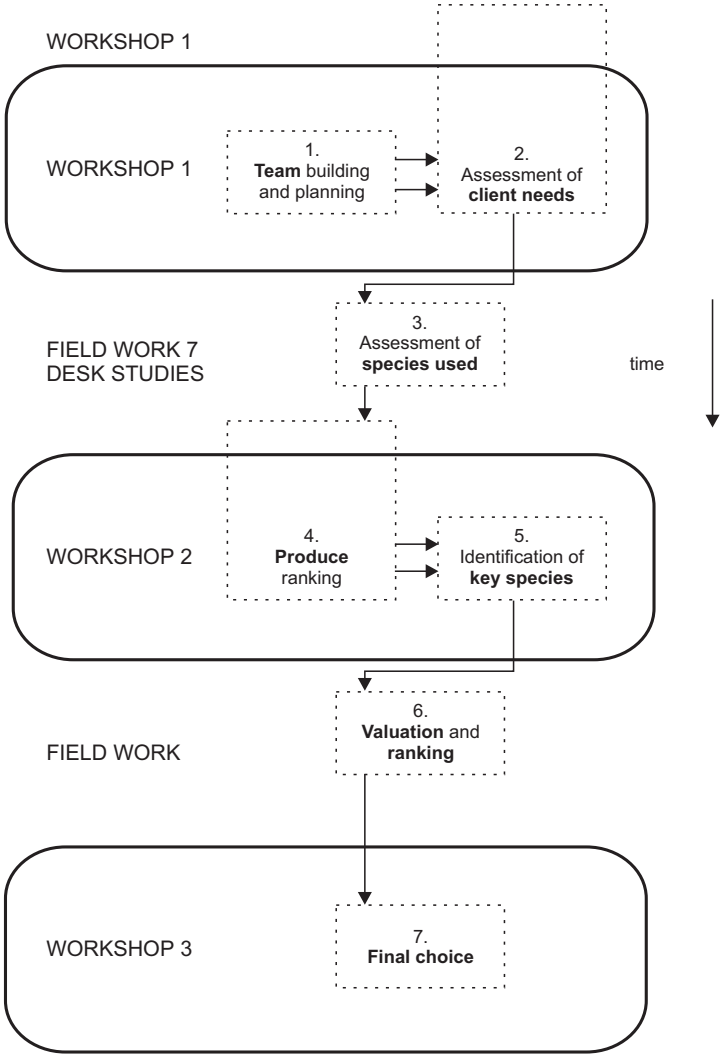
Priority setting is not just an analytical process. It also tries to bring about the agreement and the consensus that the right decision has been made. Priority setting has make room for discussions, because it is only by challenging the initial outcome, that it is possible to improve the quality of the final decisions.

Thus the procedure for choosing a tree species for improvement has been divided into seven steps (as shown in Table 3.1):

- the first step is to build an effective team among the participants from the different institutions and to agree on the application of the priority-setting approach and the modifications that may be required for the specific circumstances;
- the second step concerns the assessment of client needs. MPT improvement should be directed towards satisfying the needs of the users, and it is important that there be a shared understanding of who the clients are and what they demand from research;
- the third step is to make an inventory of all the species that are being used by the clients. This inventory forms the universe from which the priority species will be selected. Exotic species that are currently not used in the region, but that may have potential, can be added to the list;
- the fourth step is to define the most important products that the MPTs provide in the target region. Only those species producing the products of great importance to the clients are to be considered in the priority setting process;
- the fifth step is to select a limited number, e.g., four to six species that have the highest expected benefits from research, as estimated from the data collected thus far;
- in the sixth step, the value of production for these key species is estimated by means of primary data collected in a survey. This step provides the quantitative information needed to set priorities among the remaining species;
- the final step is to synthesize previous results, to review the process and to approve the choice of the priority species.

Figure 3.1 shows one possible approach to organizing the priority-setting process. Ideally, the workshops in the priority-setting process are added on to other events to reduce costs. In particular, the last workshop, which is one day only, may not in itself justify long journeys.

The priority-setting process therefore involves collecting a broad set of data on many species at the earlier stages, and more detailed information on a limited number of species at later stages. At the initial stages, information is collected on the user groups of MPT species and on the principal uses of the MPTs themselves. This information is used to reduce the



Note: Steps 2 and 4 can be initiated before the workshop, but the consensus on the results of these steps should be achieved in the workshop. Feedback is possible at any step.

Figure 3.1: A schematic presentation of the MPT species priority-setting process

number of species under consideration. By the fifth step, "Identification of priority species", only a few species remain. In the final steps, sufficient information has been collected about these species to make an informed decision on setting priorities among them. As Table 3.1 shows, the technical leadership of the steps may change; it is, however, important that one coordinator is responsible for the whole process.

13-year-old Garcinia cola plantation of a farmer near Kumba, Cameroon

Roger Leakey

Table 3.1: An Overview of the Steps in the Priority-Setting Process

Step	Rationale	Objectives/ output	Technical leadership	Participants	Information required	Methods	Time and resources1
1. Team building and planning	The skills and knowledge of many people throughout the region are needed.	Agree on concepts/methods, assemble team, obtain commitments to participate, define target area.	Research manager or network coordinator.	National program and international center representatives. Social scientists and biophysical scientists.	Experience of others who conducted similar exercise; familiarity with MPTs; familiarity with MPT priority setting guidelines; geographic and climatic information.	Planning workshop.	One or two days; if possible, in connection with step 2 and other activities.
2. Assessment of client needs	Results of research should make the greatest possible contribution to the welfare of the clients (e.g., resource-poor farmers).	Define user groups and their problems. Identify products that farmers are most interested in and that may best meet their needs.	Social scientis.t	National program and international center representatives. Social scientists and biophysical scientists.	Description of user groups. Description of farmer problems (from farmers' researchers', and key informants' views). Long-term perspective required.	Review of secondary data (diagnostic surveys, census data, zoning exercises, GIS) as compiled in country or regional papers.	1-2 person-weeks per target area. Some travel may be necessary.
3. Assessment of species used by clients	A clear understanding of the possible activities that should be undertaken is required.	List MPTs preferred by farmers in each group, their suitability in agroforestry practices, and products they provide.	Ethnobotanist or social scientist with field survey experience.	Interdisciplinary survey teams. Social scientists and biophysical scientists with survey experience and/or botanical expertise.	General information on trees that farmers have and, their uses, as well as trees that could be introduced.	Review of secondary data on farmer preferences, MPTs and agroforestry practices. Farmer preference surveys throughout the region.	6-12 person weeks (2-4 people for 3 weeks) per survey are depending on its size. Two weeks for field work, one week for analyzing and reporting.
4. Ranking of products	By ranking products, the focus is on those MPTs that provide the most important ones. The range of alternative MPT species will be reduced at a low cost.	Choose 1-2 products and draw up a list of MPT species that provide them.	MPT specialist.	National program representatives from social and biophysical disciplines.	Current and future importance of products and their improvement potential.	Secondary information. (Reports on farmer preference surveys, diagnostic surveys, expert consultation). Workshop or desk survey.	1-3 days. Desk survey may take a month or more to complete if communication is by mail.

Table 3.1: An Overview of the Steps in the Priority-Setting Proces (continued)s

Step	Rationale	Objectives/ output	Technical l eadership	Participants	Information required	Methods	Time and resources1
5. Identification of priority species	List of priority species needs to be reduced to a number for which detailed information can be collected.	Select 4-6 priority species on the basis of their researchability, expected adoption, and modifiers.	MPT specialist.	Representatives of national and international institutions.	Researchability of candidate species, their expected adoption, and modifiers.	Workshop or desk survey by mail to rate candidate species across criteria representing researchability, expected adoption, and modifiers.	2-3 days for workshop. One week for managing the survey. One month may be required before results can be obtained from desk survey.
6. Valuation and ranking of priority species	To make the final choice, more detailed information is required on the priority species.	Rank species by value of production. Update ranking on researchability expected and modifiers.	Social scientist (economist).	National survey teams.	Field level data on production, marketing, consumption, and future trends of products of top MPT species.	Valuation survey.	Per survey area: 4 people x 4 weeks for field work. One researcher x 3 weeks for analysis/reporting. One assistant x 2 months for data analysis.
7. Final choice	Decision makers now have sufficient information to make decisions and close process.	Choose final species, define research objectives. Write final report.	Research manager or network coordinator.	National program and international center representatives (same as in step 1).	From step 1-6.	Available from other steps. Workshop to develop consensus and publicize results.	1 day workshop.

1. Time and resources required vary depending on the specific circumstances. Amounts shown are based on experience in Cameroon and Nigeria.

Step 1: Team Building and Planning

Table 3.2: Team Building and Planning

Rationale	Objectives/ output	Technical leadership	Participants	Information required	Methods	Time and resources
The skills and knowledge of many people throughout the region are needed	Agree on concepts/ methods, assemble team, obtain commitments to participate, define target area	Research manager or network co-ordinator	National program and international center representatives Social scientists and biophysical scientists	Experience of others who have conducted a similar exercise Familiarity with MPTs Familiarity with MPT priority-setting guidelines Geographic and climatic information	Planning workshop	One to two days; if possible, in connection with step 2 and other activities

Rationale, Objectives and Output

Planning research to improve the welfare of resource-poor farmers is most effective when it is interdisciplinary, involving researchers from both biophysical and socioeconomic disciplines. Involving different disciplines helps to ensure that all important aspects of a problem are considered. For the same reason, there needs to be a good mix of persons from the different national and international institutions (including extension and development organizations) working on MPTs in the region. Involving collaborators at the planning stage of the exercise reinforces their commitment to participate and to support the results of the process. A strong team spirit will help to get quick and reliable results.

During the team building and planning process, concepts and methods for achieving the goal will be discussed and agreed on, as well as a detailed work plan. Decisions should be made by consensus. Participants commitment themselves to participate in the complete process and should be able to provide an indication of the time they will allocate to the project. The co-ordinators should promote close contact and communication amongst team members to ensure agreement on the tasks and methods, to share the information collected, and to assemble and interpret the results.

The participants should agree on the target area for MPT improvement. Ideally the target area should be ecologically homogeneous, i.e. with similar climatic and edaphic conditions. Nevertheless, ecological homogeneity is a very relative concept, depending on the scale of analysis, and it is very difficult to define unambiguous criteria for defining area boundaries. In the exercise in West Africa, the regional boundaries were defined using previous zonification work done at ICRAF. In this case, the most important aspect is to be sure that everybody agrees which areas are within the target zone.

Leadership and Participants

The chairman of this meeting should be the research leader of the institution that has initiated this exercise or the leader of a research network within the ecoregion. To emphasize the importance of the priority-setting exercise, it is important that the research leader be in-

volved right from the planning stage. Participants will be scientists from national and international institutions, involving many different disciplines. At least one representative of each collaborating institution within the region should be invited.

Information Required

As this is the first meeting, basic information is required on how to implement the priority-setting process. It would be useful to involve a resource person who has participated in a previous priority setting exercise in a different region.

Methods

The team building and planning is best done during a workshop in a central location within the target ecozone. During the workshop, participants will review available priority-setting methods and develop a work plan.

Time and Resource Requirements

For the initial planning workshop, one to two days will give sufficient time. This should be combined with other regional activities to save on the budget. It may also be combined with step 2 (which follows) and with training for the farmer preference surveys to be conducted in step 3.

Step 2: Assessment of Client Needs

Table 3.3: Assessment of Client Needs

Rationale	Objectives/ output	Technical leadership	Participants	Information required	Methods	Time and resources
Results of research should make the greatest possible contribution to the welfare of the clients (e.g., resource-poor farmers)	Define user groups and their problems Identify products that farmers are most interested in and that may best meet their needs	Social scientist	National program and international center representatives Social scientists and biophysical scientists.	Description of user groups Description of farmer problems (from farmers', researchers', and key informants' views) Long-term perspective required	Review of secondary data (diagnostic surveys, census data, zoning exercises, GIS) as compiled in country or regional papers	1-2 person-weeks per target area Some travel may be necessary

Rationale, Objectives and Output

It is necessary to assess the clients' problems and needs to ensure that the species priority-setting exercise is end-user oriented. The aim of this step is to define the different types of clientele or user groups for the planned research within the ecozone. A user group is a group of farmers with roughly similar circumstances, that is, having comparable resources, enterprises, practices, and socioeconomic and biophysical environments (see Chapter 2, Stakeholders). User groups may be distinguished on both biophysical criteria, e.g., soil type and rainfall, and socioeconomic features, e.g., gender and access to markets (Box 3.1). For example, farmers within the coffee/dairy producing region of the bimodal highlands of Kenya may be one user group. Their common need may be improved quality of fodder for dairy animals during the dry season. Thus by defining the user groups, a list of the possible products that are candidates for consideration in MPT improvement (e.g., fodder, food, timber) can be drawn up. Also, the user groups form the basis for the sampling frame that guides the survey work in the assessment of species used by clients (step 3) and the ranking of priority species (step 6).

Information Required

A detailed description of the user groups and of the perceived need of the farmers (from researchers, key informants and farmers themselves) is needed. It is also necessary that the focus be on the long-term future (i.e. 10-20 years), to avoid initiating work on problems that will no longer be relevant by the time the research is completed.

Methods

The preliminary list of farmers' needs (including possible species to alleviate these problems) is assembled on the basis of secondary information: characterization, diagnostic, ethnobotanical, and other studies describing farming systems and multipurpose trees in the ecozone. For each user group, NARS team members should collect information on their main problems and the tree products needed to alleviate the problems. Information should

Box 3.1: Defining User Groups in Cameroon and Nigeria

The forest zone of southern Cameroon is fairly homogeneous biophysically. Moreover, the main crops across the zone are similar — cocoa is the main cash crop and cassava is the main food crop. But there were important socioeconomic differences which led to the definition of three different user groups across the zone: east, central and south. The east is characterized by low population density, easy access to forests, and poor market infrastructure (e.g., roads and transportation). In the central part of the zone, around the capital city of Yaoundé, population density is high, access to forested areas is low, and market infrastructure is well developed. In the south, population density is low, access to forests is high, and there is a developed infrastructure for exporting fruits to neighboring Gabon. Moreover, each area is inhabited by members of different ethnic groups who may have different preferences with regard to tree products. Finally, within each group, it was important to distinguish between males and females as they were likely to have different preferences with regard to species. Therefore we deliberately aimed at interviewing both males and females. In order to get valid information, we found it important to interview females separately from males.

In the forest zone of southern Nigeria, differences in cash crops were used to define the major user groups in the area. In the west, most farmers grow cocoa and kola nut. In the central region, rubber is an important cash crop. In the east, oil palm is the most important cash crop. As in Cameroon, we tried to interview females separately from males, as we expected them to have different preferences.

also be collected on species that can provide the products. The results of the definition of user groups can be summarized in the table presented in Annex 1. Background papers on the situation by country or region can also be prepared.

Define user groups of MPT species

Researchers should define the key user groups of MPT species across the ecozone, their main characteristics, and their relative importance in terms of population and area. Information sources will include characterization and diagnostic surveys or zoning exercises which define land use systems. Care should be taken that socioeconomic as well as biophysical factors are considered in defining user groups (Harrington & Tripp, 1984).

Identify products needed

These are identified on the basis of the main problems farmers face and the opportunities that offers towards solving these problems and to improving domestic welfare. The list may include six to ten different products. The products that farmers need and use are a good starting point for drawing up the list, but the list should also include products that researchers believe could benefit farmers. For example, in West Africa, soil fertility was not perceived to be an important problem by farmers, but, because of population growth and slash-and-burn land-use practices, researchers decided that it would be an important problem in the future.

Ricinodendron heudelotii *fruits, the kernals of which are used as a spice*

Roger Leakey

Time and Resource Requirements

Within each survey area, 1-2 person weeks need to be allocated to assemble secondary information. The time spent on collecting the data depends very much on how much has been done previously (e.g., Rapid Rural Appraisals, "Diagnosis and Design" surveys). Budget allocations need to be made for local transport in case interviews or visits to other institutions are required. It is assumed that a sufficient number of surveys assessing client needs have been previously conducted so that the team members do not have to conduct such surveys themselves.[5] As mentioned above, the necessary information can be collected before the first meeting and can then be discussed and evaluated at the meeting (Box 3.2).

5 If surveys assessing client needs are lacking, the team may decide to conduct them. Different types of surveys to define client needs are described in Mettrick (1993), Franzel et al. (1987) and Anandajayasekeram (1985).

Box 3.2: Combining Steps 1, 2, and Part of Step 3 of the Priority-Setting Guidelines in the Semi-Arid Lowlands of West Africa

Participants from four countries of the semi-arid lowlands of West Africa (Senegal, Mali, Niger, and Burkina Faso) planned their work on priority setting at a two-day team building meeting in March, 1995 (step 1). Prior to the meeting, country representatives had been asked to survey available information on client needs and user groups (step 2) in the semi-arid lowlands of each of their countries. Each representative then presented his/her results at the team building meeting. The information was useful for identifying the areas and user groups that team members would focus on in the priority-setting exercise.

Participants had also been asked to review studies on farmers' uses and preferences among tree species. Although some information was available, it was decided that farmer preference surveys were needed in all four countries. Participants went on to plan these surveys at the same meeting, discussing interview methods, defining areas to be sampled, and drawing up budgets and work plans (step 3). The team-building meeting thus proved very efficient and allowed the team to complete the assessment of client needs and to plan work for determining the species used and preferred by clients.

Step 3: Assessment of Species Used by Clients

Rationale, Objectives and Output

To decide which MPT species need improvement, we have to determine farmers' top priority species, using primary or secondary data. We also need to know the reasons for their preferences. The list should include the products they provide, the niches on or off farm where they grow, and the agroforestry practices (e.g., hedgerow intercropping or boundary planting) in which they are used. The information should be assembled into a report describing user groups, their main problems and opportunities, principal MPT products, main agroforestry practices used, and main species by product and agroforestry practice. Researchers may contribute species to the list, based on the species' potential to solve farmer problems. Researchers' contributions to the list of species are especially important when farmers are new to an area and thus have limited knowledge of their environment.

The output of this step can be organized into a table that summarizes the relative preferences that have been expressed for each species in each area, and that indicates the principal reasons for the preference, the principal market niche, and the principal improvement objectives (Annex 2).

Table 3.4: Assessment of Species Used by Clients

Rationale	Objectives/ output	Technical leadership	Participants	Information required	Methods	Time and resources
A clear understanding of the possible activities that should be undertaken is required	List MPTs preferred by farmers in each group, their suitability for agroforestry practices, and products they provide	Ethnobotanist or social scientist with field survey experience	Interdisciplinary survey teams. Social scientists and biophysical scientists with survey experience and/or botanical expertise	General information on trees that farmers have, their uses, as well as trees that could be introduced	Review of secondary data on farmer preferences, MPTs and agroforestry practices Farmer preference surveys throughout target region	6-12 person weeks (2-4 people for 3 weeks) per survey area depending on its size Two weeks for field work, one week for analyzing and reporting

Leadership and Participants

Both socioeconomic and biophysical scientists are needed in the planning and execution of the survey. draw up the survey instrument or questionnaire, design the sample and conduct the interviews. Biophysical scientists identify MPTs during farm visits, assess tree problems and improvement objectives with farmers, and nominate species to solve farmers' problems. It is necessary for the leader to have survey experience and that an interdisciplinary team should be made up of people from the national research institutions. As many staff as possible from the collaborating institutions should be involved so as to (1) complete the work on time, (2) draw upon staff with farm-level expertise at the national and field level, and (3) ensure that a consensus be achieved on the conclusions of the exercise.

Irvingia gabonensis *cotyledons are pressed into a cake for long-term storage*

Roger Leakey

Information Required

It helps if species used in the area are already known to the survey participants. Secondary sources, such as the ICRAF MPT data base (von Carlowitz et al., 1991) or texts on tree species found in the area or similar environments, will also be useful.

Methods

Farmer preference surveys may be needed to identify the main species farmers prefer and use (Box 3.3). Farmer preference surveys aim at collecting information on three issues for the priority-setting process:

- Farmer preferences for MPT species and the reasons behind their preferences. This is done by asking farmers to list the main MPT species they grow or use, rank these according to their preferences, and register the species' main uses and the reasons for their preference. Most of the reasons will concern the use of the products but, others may be mentioned; e.g., rapid growth or compatibility with crops.
- MPT species characteristics that help to assess the suitability within the principal agroforestry practices. This is done by recording the farm niches/agroforestry practices in which trees are primarily found. This information helps to define the suitability of different species for existing or proposed agroforestry practices.
- Information on research opportunities for the different MPT species. This is done by asking farmers about the problems that they face in growing and using each species, and the opportunities they see for improvement.

Box 3.3: The Farmer Preference Survey in HULWA

Considerable work may be required to identify and rank the species used and preferred by clients. In the humid lowlands of West Africa, for example, information was available from secondary sources on user groups, farmer problems, and priority products. However, data on MPT preference and use by farmers was found to be lacking. Hence, researchers decided to conduct farmer preference surveys in three of the target countries.

This survey involved a sample of 94 farmers in nine land-use systems across three countries. At a meeting in Cameroon in December 1993, NARS and IARC scientists agreed on survey objectives, planned the survey, and designed a questionnaire. National teams conducted the survey and analyzed the data and by March 1 1994, a draft report of the results was completed. In each country, the surveys required nine to fourteen researcher-weeks to complete.

The following species were the most popular among the farmers across the zone (their main uses are shown in brackets):

1. *Irvingia gabonensis* (food, cash, medicine, timber, firewood);
2. *Dacryodes edulis/D. klaineana* (food, cash, medicine, firewood, shade);
3. *Chrysophyllum albidum* (food, cash);
4. *Ricinodendron heudelotii* (food, cash, medicine, timber, firewood);
5. *Garcinia cola/G. afzelii* (food, cash).

The researchers nominated five other species, namely:

- *Cola edulis*, because of its importance in consumption and marketing throughout the region and its export potential;
- *Tetrapleura tetraptera*, because it was believed to be popular and marketed throughout the region;
- *Spondias mombin*, also because it was believed to be popular and marketed throughout the region;
- *Artocarpus communis*, which is the most widely preferred species in Ghana but did not score in the other countries and was thus excluded from the region-wide priority list;
- *Annona squamosa*, which was the second most popular species in Ghana but also did not score in the other countries.

The survey highlighted the importance of fruits for consumption as the most important product from MPTs (see Box 3.5). Eleven of the 15 species rated highest by farmers in the survey were preferred for their fruits.

This result clearly shows the importance of the farmer preference survey (Adeola et al., 1994). Without it, the MPT improvement efforts might have targeted a set of species less important for farmers.

If farmers have poor knowledge of the species in their region, for example, if they are recent immigrants, a farmer preference survey may be of limited value and should be modified (Box 3.4). In theory, the farmer preference survey should be representative of the entire region. In practice, the survey may be limited to those areas where it is possible to mobilize survey teams. Within these areas, the farmer survey should cover the different user groups, which will have been defined earlier on the basis of previous characterization/diagnostic work. The farmer preference survey does not aim at collecting a data set for which tests of

Box 3.4: The Farmer Preference Survey in Peru

The survey in three areas of the Peruvian Amazon confronted the researchers with an interesting problem: about half of the farmers in the region have migrated from other areas of the country. These immigrants were defined as the main potential beneficiaries of improved agroforestry production systems which could provide them with more sustainable land-use alternatives. Most have arrived recently, and thus their knowledge about their new environment is limited. Whereas the production of food crops in this situation does not pose major problems, the large potential of the tree flora for food, timber, medicine or other uses cannot be appreciated. The researchers therefore decided also to interview members of groups who were born in the area. These people have an intimate knowledge of the trees around them and were thus able to provide important information about the uses of and preferences for the indigenous species.

statistical inference can be applied. Rather, it attempts to obtain reliable information on farmer preferences, species, niches, and problems in as short a time as possible. Normally, ten sites (that is, clusters of villages), involving a minimum of four interviews per user group per site are sufficient. If possible, the interviews at each site are spread across different villages. The actual number and distribution of sites depends on the size of the region, and the variability within it as indicated by the number of different user groups that have been identified. The greater the expected variation, the higher the number of sampling sites and the larger the sample size. A survey team of four persons should be able to complete

Farm interview for the valuation survey in Oyo State, south-west Nigeria

Steven Franzel

four interviews per day (two 2-person teams each complete two interviews per day). Thus in two weeks, the team should be able to visit ten sites, conducting 40 interviews. Time requirements may vary, depending on transportation and logistics.

Interviews are conducted by a minimum of two people with different disciplinary backgrounds. Ideally the interview team should combine socioeconomic and biophysical disciplines. One person will lead the interview, the other will concentrate on taking notes. It is important to balance the views and perspectives of both sexes in the farmer preference survey, because men and women may value different aspects of the same species and may traditionally be in charge of different species. The aim should be to spread the number of interviews per site equally among men and women. For this purpose it is recommended that female researchers be invited to participate in the survey. Interviewing males and females separately is often preferable; in mixed interviews males tend to dominate the responses.

Where possible, group interviews, involving four to six farmers or more, are preferred as this gives a consensus of opinions. Nevertheless, group interviews may not be feasible under certain circumstances (e.g., they may be difficult to organize where farmers do not live in villages). The scientist in charge of the survey can make a judgment on the most feasible approach, depending on his/her local knowledge. Efforts should be made to interview the entire range of the different types of farmers found in an area. Researchers should avoid biasing their sample towards high-income, progressive farmers or local leaders, as these may have preferences not representative of the majority of farmers (Martin, 1995). The chances of bias are higher if extension agents are solely responsible for choosing the sample, because they tend to pick out their "best" farmers. A semi-structured questionnaire is used to enhance the comparability of the data across farms, and to help focus the interviews. At the same time, the interviews are informal. Typically, the question concerning preferred trees generates a discussion that may last twenty minutes. The interview does not usually take more than two hours and should ideally be completed in one hour. An example of a farmer preference survey with its application guidelines is given in Annex 3.

Time and Resource Requirements

The farmer preference survey takes about nine researcher weeks for a small area with relatively good roads and transport. Four people spend two weeks in the field and take one week to analyze the data. In Ghana, with about 14,000 km² and five million people in the HULWA ecozone, a survey team completed the farmer survey in ten days, and in another week analyzed the results and wrote them up. The time allocation needs to be greater for a larger area or where road access is difficult. In Nigeria, with about 37,000 km² and 36 million people within HULWA, it took three weeks of field work with one week to write up.

Step 4: Ranking of Products

Table 3.5: Ranking of Products

Rationale	Objectives/ output	Technical leadership	Participants	Information required	Methods	Time and resources
By ranking products, the focus is on those MPTs that provide the most important ones; the range of alternative MPT species will be reduced at a low cost	Choose 1-2 products and draw up a list of MPT species that provide them	MPT specialist	National program representatives from social and biophysical disciplines	Current and future importance of products and their improvement potential	Secondary information (Reports on farmer preference surveys, diagnostic surveys, expert consultation) Workshop or desk survey	1-3 days. Desk survey may take a month or more to complete if communication is by mail

Rationale, Objectives and Output

The assessment of client needs and species used by clients helps to identify the products provided by MPT species that farmers are most interested in. In this step, the products need to be ranked, because an effective improvement program can focus only on one or two main products (although the selected species may provide other products as well). The ranking of products will also considerably reduce the number of species to assess during the following steps, since many trees will not provide them.

A maximum of two products will be chosen based on farmers' preferences, and a list of species providing each product will be drawn up. The number of species will thus be reduced to 10-30 in total. If the number of products is higher than two, the screening process in this step may be exceedingly cumbersome and time-consuming (Box 3.5).

Leadership and Participants

This exercise may be led by any member of the interdisciplinary team.

Information Required

Information is required on the relative importance of the products within the region at present and in the future, and the improvement potential of these products.

*Present need*s farmers use from the preferred species in step 3. Future needs can be drawn from step 2, but the team members may need to update the findings of the farmers' needs by conducting a trend analysis. Future soil fertility problems in HULWA, as presented in step 2, are an example.

The *improvement potential* concerns the chances of success when researching a specific product. Improving for soil fertility is considered to be more difficult than improving for fodder, because not much is known about how improved species influence soil fertility. On the other hand, for fodder quality, there are well-established assessment parameters,

Box 3.5: Ranking MPT Products in the Humid Lowlands of West Africa

In HULWA, multipurpose trees deliver several products and services. The most important are fruits and food, firewood, timber, medicine, stakes and poles, fodder, live fences, soil erosion control and fertility improvement. Some of these products/services may deliver income to farmers, whereas others may be principally used within the household or contribute to the sustainability of the farming system. At the beginning of 1994, at a workshop in Yaoundé, participants from four West African countries rated these products on their importance. Based on the results of preference surveys in three countries, fruits and food stood out for their present and expected future importance to farmers. At the same time, the researchability for fruits and food was considered high. Improvement strategies such as lengthening the harvest period, reducing seasonality or improving fruit quality could provide significant results in a reasonable period of time. The other products were either considered to be less important (live fences) or less amenable to improvement research (fertility management). Consequently, the remainder of the priority-setting exercise focused on tree species providing fruits and food.

	Present value to farmers (A)	Future value to farmers (B)	Potential contribution of research (C)	Institutional mandate (D)	Total
Fruit/food	3	3	3	3	27
Soil fertility	2	3	2	3	15
Fodder	1	2	3	2	9
Medicine	2	2	2	1	4
Timber	2	2	1	2	4

Note: total = (A+B) x C x D

such as protein content, palatability, biomass production, and much experience in plant improvement.

Some institutions might also need to assess how well a certain product fits within their mandate. For example, medicinal research might not be considered the responsibility of an agricultural research institution, so medicines may be removed from the products list.

Methods

The six to ten candidate products nominated in step 2 should be reviewed and a ranking procedure drawn up. The system involves rating each product on a 1 to 3 scale (3 being very important and 1 being of little importance) according to the three criteria discussed above (Annex 4). Product groups are rated giving equal weight to all factors. Species that are not on the lists of the two most important products are eliminated from the analysis.

Time and Resource Requirements

The necessary information can be gathered in one to three days. The product-ranking exercise can be carried out as a group activity, preferably as part of another meeting or work-

shop. Or, the product-ranking exercise can be carried out as a desk survey by mailing questionnaires to team members and others, but care should be taken that the deadline for responses is respected. Ranking of products may be conducted as part of the assessment of client needs in step 2; the disadvantage of doing so is that information on farmers' preferences among different products from the survey in step 3 will not be available.

Dacryodes edulis *tree and fruits being harvested near Kumba, Cameroon*

Roger Leakey

Step 5: Identification of Priority Species

Table 3.6: Identification of Priority Species

Rationale	Objectives/ outputs	Technical leadership	Participants	Information required	Methods	Time and resources
List of priority species needs to be reduced to a number for which detailed information can be collected	Select 4-6 priority species on the basis of their researchability, expected adoption, and modifiers	MPT specialist	Representatives of national and international institutions	Researchability of candidate species, their expected adoption, and modifiers	Workshop or desk survey by mail to rate candidate species across criteria representing researchability, expected adoption, and modifiers	2-3 days for workshop One week for managing the survey One month may be required before results can be obtained from desk survey

Rationale, Objectives and Output

This step is designed to reduce the number of potentially useful species further to a limited number, e.g., 4-6, priority species for the one or two major products. The objective is to rate species on specific criteria that represent researchability, expected adoption, and modifiers. As a result we can select those species where research has most to offer, however without as yet having a clear idea on their economic importance. Reducing the number of species will allow us, in the next step, to collect more detailed information on these few species.

Leadership and Participants

An MPT specialist will lead this part of the exercise, together with the team members. Each institution involved should be represented in the team.

Information Required

The activities in this step draw upon detailed information about the species, available from secondary data, previous steps in priority setting, and specialists' own knowledge about the region, its farmers, and its MPTs. The species' researchability, the expected adoption of improved material, and certain specified modifiers are assessed. These factors are explained in more detail in the following section.

Methods

Researchability considerations

Researchability concerns the potential of research to improve the species. The following six criteria are suggested: level of genetic variability, germplasm availability, knowledge base, speed of reproduction, potential for research breakthrough and uniqueness of research efforts. Each criterion is explained in detail in Annex 5, Table 1, notes. The specialists first weight the different criteria on a scale of 1 (of little importance) to 5 (high importance). Then they rate candidate species from 1 (low) to 3 (high) on each criterion.

Researchers need to also assess the precision of their ratings and possible sources of information for improving their rating. For example, they may decide that they know very little about the degree of genetic variability of a species and wish to consult farmers or key informants about this. Thus the exercise is designed to note information gaps as well as to rate species. Finally, the overall scores for each species are computed by summing up the scores on each criterion (Box 3.6).

Box 3.6: Researchability Survey in HULWA

In March-April, 1995, a survey of researchers was conducted to obtain their views on the relative researchability of 10 important species in the humid lowlands of West Africa. A questionnaire was mailed to 13 scientists, who rated the species they knew well on six criteria: risk of duplication of research efforts should the species be selected for improvement, amount of genetic variation, level of indigenous knowledge, available germplasm, distribution of the species, age to first fruiting, and background biological knowledge.

The results showed a high correlation between researchability and farmer preferences. The five highest-ranking species in the farmer preference survey (Box 3.3) were among the top 7 in the researchability survey. Scientists decided to maintain the farmers' five highest ranking species as there was not much difference in the researchability and farmers' own rankings. These five species were then considered in the next step, step 6, validation and ranking of priority species.

If information is not available on how a species performs on a given criterion, it can be given a rating of 2 (medium) with an asterisk (*). If much information is lacking, calculation of a final score can be delayed until sufficient information becomes available.

Expected adoption

The researchers should rate candidate species according to the potential expected adoption, that is, the speed and the extent with which improved material would be adopted. Eleven criteria are suggested. They are: ease of establishment; precocity; pest/disease/weed resistance; adaptability across regions and socioeconomic groups; compatibility with crops; coppicing/pruning ability; commercial potential; value of products per unit labor and land; production of planting material; and uses in different production systems/niches. Detailed definitions of each are given in Annex 5, Table 2, notes. As with the previous section, researchers weight each criterion on a 1 to 5 scale and then rate candidate species on each criterion. The total score of a species is then calculated by summing the scores on each criterion.

Modifiers

Virtually all of the criteria used above for evaluating species affect the expected monetary impact of an improvement program. For example, a high level of genetic variability, greater germplasm availability, and high commercial potential will all lead to a greater research progress and thereby to the greater monetary impact of an improvement program. But whereas increasing monetary impact is crucial, there may be other criteria to consider in as-

sessing impact. For example, decision makers may wish to emphasize the contribution of research to improving equity among socioeconomic groups, to contributing to the welfare and incomes of women, or to improving the natural resource base. Such criteria are labeled modifiers, because they 'modify' the objective of maximizing monetary impact.

The group needs to decide which modifiers are important and how much weight to give to each. This can either be done at this stage, or if possible, at a later stage when the specific species and issues involved in improvement are clearer. Weights are specified in terms of the importance of each modifier to society. For example, if improving a particular species might have a positive effect on equity, then its score could be adjusted upward by 10%; a negative effect could cause a score to be adjusted downward by 10%.

Once researchability, expected adoption and modifiers have been assessed, a relative gain score (RGS) can now be computed for each species (Annex 5, Table 4).

RGS = Score on researchability x Score on expected adoption x Modifiers.

Note that the relationship among the components of the relative gain score is multiplicative, not additive. For example, if a species receives a zero on researchability, it does not matter how well it performs on expected adoption - its potential impact is zero. Table 4 in Annex 5 can be used to calculate the RGS. The RGS has a relative rather than an absolute meaning. The higher the score, the more likely a species would be to be a candidate for improvement. However, the score itself has no specific meaning.

Chrysophyllum albidum tree in a homestead garden in Oyo State, south-west Nigeria

Steven Franzel

The 4 to 6 species with the highest scores are those which will be considered in the next step, the valuation survey. Some decisions on these species may have to be delayed, pending the collection of additional information to fill information gaps.

Time and Resource Requirements

All three exercises — researchability, expected adoption, and modifiers — may be carried out in a workshop where a consensus can be reached. Alternatively, they can be carried out as a desk survey. If done in a workshop, organizers should distribute the forms, including the candidate species and criteria, at least one month before the workshop. Participants can then gather the necessary information and rate the species on each criterion. During a 2- to 3-day workshop, they can share and compare their findings and reach a consensus. Workshops are preferred to desk surveys because they promote information sharing and consensus building. Information concerning the priority species will be further improved during the farmer surveys to be conducted in step 6.

Step 6: Valuation and Ranking of Priority Species

Table 3.7: Valuation and Ranking of Priority Species

Rationale	Objectives/ output	Technical Leadership	Participants	Information required	Methods	Time and resources
To make the final choice, more detailed information is required on the priority species	Rank species by value of production Update rankings on researchability, expected a doption, and modifiers	Social scientist (economist)	National survey teams	Field-level data on production, marketing, consumption, and future trends of products of top MPT species	Valuation survey	Per survey area: 4 people x 4 weeks for field work; one researcher x 3 weeks for analysis/ reporting; one assistant x 2 months for data analysis

Rationale, Objectives and Output

To choose the final priority species, the value of production should be combined with the assessment in step 5 on the relative gains to be expected from research. This will allow for a clear ranking of each of the top five priority species. In addition, field work in this step may assist in updating rankings on researchability, expected adoption, and modifiers. The output on value of production in step 6 may be summarized in two tables (Annex 6).

Leadership and Participants

A social scientist will lead and analyze the data in this exercise, as the economic valuation of MPT products is the principal objective. National survey teams are needed to conduct field surveys to estimate production and market values.

Information Required

Data are required about the production, consumption and marketing of the main products and byproducts of the top ranking species. Data should also be collected to fill important information gaps in other steps. For example, there may have been uncertainty over certain growth characteristics, such as age to first fruiting, in the ratings of researchability.

Methods

Valuation survey

Once the final set of species has been identified, information about their value to farm households needs to be collected. This is done by means of a survey which covers information about

- sale and consumption;
- farmers' ideas and interest in improving the species;
- trends in production and potential future demand for the products;

- possible remaining information gaps concerning farmers' management of species, problems encountered, and growth characteristics.

This survey needs to be more thorough than the farmer preference survey in order to obtain meaningful results which can be analyzed statistically. In most cases, several different methods will be needed to assess the value of products and their potential value. In HULWA, we used four data collection methods:

1. a formal survey of 160 farmers, 80 in Cameroon and 80 in Nigeria;
2. a survey of about 10 farmer key informants (one per village cluster) to collect information that was not expected to vary much within a cluster (e.g., gender roles in harvesting, processing, and marketing);
3. a survey of key informants to collect information on relative quantities marketed, the nature of the demand for different fruits, and market channels;
4. measuring of local units (buckets, basins, etc.) to allow for metric conversions.

Annex 7 gives examples of data collection forms.

Sale and consumption. This is the heart of the valuation survey. Estimating the production and the value of the produce is the most difficult part of the questionnaire. It requires considerable tact and cross-checking (Box 3.7). In many cases, the complexity of valuing products precludes use of a formal survey questionnaire or allocating the task to technicians or enumerators. Researchers may be better off interviewing a relatively small sample of farmers themselves. In HULWA, we found that we were able to obtain good data on the numbers of trees per farmer in a formal survey, but data on production were poor. We obtained production and consumption data from secondary data and from a few interviews that researchers conducted with farmers who were able to estimate their production and consumption.

Farmer ideas and interest in improvement. This section deals with the farmers' suggestions for improvement (e.g., fruit size, time to bearing, improvement of fruit storability). These answers will guide the final decision about the type of improvement research that will be carried out with the species.

Trends in production and marketing. These questions focus on the marketability of products, in order to assess the potential for increasing and absorbing extra production. For example, finding out whether urban dwellers consume the product and whether people consume more of the product as their incomes increase helps to assess its potential future demand. One should also consider whether the market can absorb large increases in production and what the effect would be on species. If data exists on sales records over the last 3-4 years, this may help in trend analysis.

Management and growth. How farmers reproduce and manage a species helps reveal the value they give to the species and their willingness to invest in it. This will help in assessing the adoption potential of improved material. It also helps to fill gaps in information from the previous steps.

Finally, the values of the different products that the MPT provides have to be added. The total value will normally strongly be influenced by the value of the principal product (in

Box 3.7: Valuing Fruit Production in the HULWA Valuation Survey

Estimating fruit production and value requires considerable tact and cross-checking. The first task is to understand when, how, and by whom the tree is harvested. The next is to determine the marketing channel of the product; how it is transported, processed, and finally, consumed, sold, or otherwise disposed of. An understanding of farmers' local units and measures is critical. Several examples from HULWA illustrate the complexity of the process:

Case study 1:
In Nigeria, a farmer was able to estimate the average number of baskets of *Chrysophyllum albidum* fruits sold per tree. He also told us the price he received per basket. We were thus able to calculate the value sold. The farmer could not estimate the quantity his family consumed but he was able to estimate the percentage of total production consumed. Thus we could calculate the total value of production by dividing the value sold by (1 minus the proportion consumed).

Case study 2:
A second Nigerian farmer knew the number of baskets of *Irvingia gabonensis* fruits she produced per tree, and the number of trees she had. We obtained the price per basket she received. These gave us the total value of production. The quantities sold and consumed could be derived by asking the relative proportions she sold and consumed.

Case study 3:
A Cameroonian farmer knew the total quantity of *Dacryodes edulis* fruits he had sold and the total amount of money he received. In contrast to the Nigerian farmers above, he had no idea how much fruit a single tree produced. He did not know how much his family consumed but he was able to estimate the proportion. We used the formula in Case study 1 above to arrive at total value of production.

Case study 4:
In Nigeria, some farmers sell the produce of their trees to middlemen who then harvest the trees. The farmers told us the money they received for allowing the middlemen to harvest the fruits. They were also able to estimate the quantities and the share of total production they consumed themselves before and after the middlemen harvested. We thus used the formula in Case study 1 to calculate the total value of production.

It is possible to cross-check answers by asking a question in several different ways. For example, the answers for quantity consumed and quantity sold can be added and then compared with the answer for total quantity produced. Furthermore, because production is highly variable from season to season and from tree to tree, it is important to obtain estimates from a number of years or to obtain information on the range in annual production across a number of seasons or years. In Nigeria, we asked people to estimate last year's production and production in good and bad years.

It is also important to ask questions about byproducts (e.g., medicine, firewood) as they add to the total value of the species.

HULWA the fruit and food). Nevertheless, some other products will almost always contribute to the total value, e.g., firewood. The wood value of the tree is often calculated more easily from secondary data or data from key informants on wood quantities produced, expected life of the tree and firewood prices.

Because of the complexity of the valuation it may not be possible to set a value or even a range of values on the products of an MPT. But the survey should result in a relative ranking of the species by value (Box 3.8). This relative ranking will help us to choose the species in the next and final step.

Box 3.8: Preliminary Results of the HULWA Valuation Survey

Preliminary data analysis has shown that the farmers in Cameroon and Nigeria invest more time and effort in Dacryodes edulis and Irvingia gabonensis than in the other species surveyed. In terms of value of production, Irvingia was of somewhat greater importance than Dacryodes in Nigeria, but the reverse was true in Cameroon. Further analysis is needed to understand these interesting results. However, the leading role of I. gabonensis and D. edulis, relative to other species, has been confirmed by the survey.

Time and Resource Requirements

Time and resources will depend on the kinds of surveys that are required. Per region, about 19 person-weeks may be needed if a formal sample survey is conducted. Four people spend four weeks on the field work. This includes one week for training, and testing the questionnaire. After the field work is completed, an assistant will need about two months for data checking, input and analysis, and a researcher about three weeks for the analysis and report writing.

Fruits of Dacryodes edulis from various street markets in Yaounde, Cameroon. The high degree of variability in fruit size, shape, taste, and pulp-to-seed ratio may be exploited by researchers to improve quality and productivity of the species

Roger Leakey

Step 7: Final Choice

Table 3.8: Final Choice

Rationale	Objectives/ Output	Technical Leadership	Participants	Information required	Methods	Time and resources
Decision makers now have sufficient information to make decisions and close process	Choose final species, define research objectives Write final report	Research manager or network coordinator	National program and international center representatives (same as in step 1)	From step 1-6	Available from other steps Workshop to develop consensus and publicize results	1-day workshop

Rationale, Objectives and Output

After having carried out steps 1-6, there is sufficient material has been collected for a sound final decision on which priority species improvement research should be concentrated. The final output of this step can be summarized in the table of Annex 8. The table consolidates the values for modifiers, researchability, expected adoption and estimated value of production. By multiplying these four values, an indicator of the relative priority of a species is obtained. The higher this indicator, the higher the species' potential for achieving impact.

The priority species are chosen and specific research objectives defined. Finally, a report is written in which the results of the prioritization process are detailed.

Leadership and Participants

This last step should be chaired by the research director of the leading institution(s) or the coordinator of the regional research network. The participants will be members of the MPT research programs of the international and national institutions that have collaborated in the prioritization exercise. Ideally, the team will consist of the same individuals who participated in the initial meeting in step 1.

Information Required

The information compiled from steps 1 to 6.

Methods

The leading researchers in the prioritization exercise assemble the information from the validation surveys and confirm the findings of the researchability and expected adoption exercises. The outcome from the surveys may result in some changes in the findings and the relative gain scores computed in step 5. To arrive at the final score, the relative gain score is multiplied by the value of products obtained in step 6. Where actual values are not obtainable ratings may be used (Box 3.9).

The final choices will be made during a brief workshop, in which all research collaborators should be present. The leaders of the MPT priority-setting exercise will summarize

Box 3.9: Preliminary Overall Species Ratings in HULWA

Preliminary overall ratings for the highest priority species are shown below. I. gabonensis and D. edulis had the highest ratings on value and researchability. The two also received about equal ratings on speed of adoption; whereas Dacryodes fruits earlier than Irvingia, Irvingia is important in more areas throughout the ecozone. Irvingia provides more benefits to females than Dacryodes, hence its higher rating on modifiers. There was a considerable distance between these two species and the remaining three, which had significantly lower ratings on value, researchability, and expected adoption.

	Value	Researchability	Expected adoption	Modifiers	Overall rank
Irvingia gabonensis	H	H	H	H	1
Dacryodes edulis	H	H	H	M	3
Ricinodendron heudelotti	M	M	M	H	3
Chrysophyllum albidum	M	M	M	M	4
Garcinia cola	M	M	L	M	5

the entire prioritization process and show how the results were obtained. The final decision will be reached after these results have been discussed by the workshop participants.

Time and Resource Requirements

The final decision can be reached during a final workshop of one day or less. If possible, this workshop can be attached to another regional activity.

4. Conclusions

The prioritization procedure presented in this report is an effective tool for developing a short list of target species for genetic improvement research and setting priorities among them. The procedure uses a multidisciplinary approach, involving both biophysical and social sciences and integrates the views of researchers, policymakers, and farmers.

The prioritization procedure is flexible; it can be adapted to meet the particular needs of researchers. For example, in the procedures outlined in these guidelines it is assumed that researchers are primarily interested in which 1-3 species they should focus their work on. Thus much effort in data collection is on step 6, setting priorities among the top five species. But if researchers are less concerned about knowing the top 2 or 3 but more interested in knowing the top ten species, they may be more interested in increasing primary data collection at step 5.

In HULWA, in addition to arriving at a short list of species that researchers were confident about, the procedure had several other benefits. Firstly, a great deal of important biophysical and socioeconomic information was assembled about the region, its farmers, and MPT species. This information will facilitate the development of an improvement program. Secondly, the exercise was useful for improving linkages between institutions and building a spirit of collaboration. This has contributed to the rapid progress being made in the germplasm collections and propagation studies that have been started in the region, involving many of the same persons who participated in the priority-setting exercise. Thirdly, the team now has sound reasons for having chosen the species they are conducting research on. This should contribute to stronger linkages with policymakers and donors.

5. References

Adeola, A., I.O.O. Aiyelaagbe, K. Appiagyei-Nkyi, S.Y. Bennuah, S. Franzel, E.L. Jampoh, W. Janssen, J. Kengue, D. Ladipo, M. Mollet, J. Owusu, L. Popoola, S.J. Quashie-Sam, T. Tiki Manga, and Z. Tchoundjeu. 1994. Farmers' Preferences among Tree Species in the Humid Lowlands of West Africa. Paper prepared for the Workshop on Irvingia gabonensis, Ibadan, September, 1995. Under review.

Alston, J., G. Norton and P. Pardey. 1995. Science under Scarcity: Principles and Practice for Agricultural Research Evaluation and Priority Setting. Ithaca, N.Y.: Cornell University Press.

Anandajayasekeram, P. 1985. Teaching Notes on the Diagnostic Phase of On-Farm Research with a Farming Systems Perspective: Concepts, Principles, and Procedures. CIMMYT East Africa Economics Program, Occasional Paper No. 14. Nairobi: Centro Internacional de Mejoramiento de Maiz y Trigo (CIMMYT).

Burley, J. and P. Wood. 1977. A Manual on Species and Provenance Research with Particular Reference to the Tropics. Tropical Forestry Paper No. 10. Oxford: Commonwealth Forestry Institute.

Carlowitz, P.G. von, G.V. Wolf and R.E.M. Kemperman. 1991. Multipurpose Tree and Shrub Database Version 1.0. Nairobi: International Centre for Research in Agroforestry (ICRAF).

Collion, M.-H. and A. Kissi. 1994. Guide d'élaboration de programs et d'établissement de priorités. Research Management Guidelines No.2. The Hague: International Service for National Agricultural Research (ISNAR).

Contant, R. and A. Bottomley. 1988. Priority Setting in Agricultural Research. Working Paper No. 10. The Hague: International Service for National Agricultural Research (ISNAR).

Franzel, S., M. O'Dell, L. Walechsa and T. Frankenburger. 1987. Diagnosis in Farming Systems Research and Extension. Farming Systems Research and Extension Training Unit Volume 1. Gainesville, Florida: University of Florida, Farming Systems Support Project.

Harrington, L. and R. Tripp. 1984. Recommendation Domains: A Framework for On-Farm Research. Economics Program Working Paper 2/84. El Batan, Mexico: International Maize and Wheat Improvement Center.

Hoekstra, D. and I. Darnhofer. 1993. Valuation of Hedge-Row Prunings: For Fodder or for Improving Soil Fertility? In Proceedings of the Workshop "Socio-economics and On-farm Research in Agroforestry". Nairobi, 7-11 September 1992. Nairobi: International Centre for Research in Agroforestry (ICRAF).

Jaenicke H., S. Franzel and D.J. Boland. 1995. Towards a Method to Set Priorities amongst Species for Tree Improvement Research — a Case Study from West Africa. Journal of Tropical Forestry Science 7: 490-506.

Kelly, T.G., J.G. Ryan and B.K. Patel. 1995. Applied Participatory Priority Setting in International Agricultural Research: Making Trade-offs Transparent and Explicit. Agricultural Systems 49: 177-216.

MacDicken, K.G. and C.B. Mehl. 1990. Farmers Perspective on Improvement Objectives for MPTs. In Tree Improvement of Multipurpose Species, edited by N. Glover and N. Adams. MPT Species Network Technical Series Volume 2. Little Rock, Arkansas: Winrock International Institute for Agricultural Development.

Martin, G.J. 1995. Ethnobotany — a Methods Manual. London: Chapman & Hall.

Mettrick, H. 1993. Development Oriented Research in Agriculture: An ICRA Textbook. Wageningen, The Netherlands: International Centre for development oriented Research in Agriculture (ICRA).

Oppen, M. von and J.G. Ryan. 1985. Research Resource Allocation: Determining Regional Priorities. Food Policy 10: 253-264.

Raintree, J. 1991. Socio-Economic Attributes of Trees and Tree Planting Practices. Community Forestry Note No. 9. Rome: Food and Agricultural Organization (FAO).

ANNEX 1: Output of Step 2: Assessment of Client Needs

Classification of Principal Agroforestry User Groups

Country: Cameroon

User group	Location	Population size	Principal agroforestry products required			Other characteristics
			1	2	3	
Cocoa-based farming system	East province and eastern part of central province	43,000	Fruits	Timber	Medicine	

ANNEX 2: Output of Step 3: Assessment of Species Used by Clients

Relative Preference of Each Species by Survey Area

Species	% times mentioned in top 10	% times ranked no. 1	Mean rank order value[1]	Principal attribute/product	Principal niche	Principal objectives for improvement
Irvingia gabonensis	86	23	6.1	Food (cotyledons added to sauces)	Secondary forest	Bigger fruit, smaller trees

Note: It is assumed that each user group is allocated a sample size proportional to its population. For example, if 20% of the population of the humid lowlands of Cameroon is in the Cocoa-based user group of eastern Cameroon, then this user group should receive 20% of the sample size. If sample size is proportional to population, the overall results represent unbiased averages or frequencies. If sample size is not proportional to population, then results by survey area should be weighted by population.

1. If the species ranks first, it receives a rank order value of 10; if second, a value of 9, etc. If not mentioned in the top 10, it receives a 0. The mean rank order value is the mean of all values including zeroes.

ANNEX 3: Method for Step 3: Assessment of Species Used by Client

Farmer Preference Surveys, Objectives and Guidelines

Objectives

The farmer preference survey aims to collect information on three issues for the priority-setting process:

1. Farmer preferences for MPT species and the reasons behind their preferences. This is done by asking farmers to list the main MPT species they grow or use, rank these species according to their preferences, and register the species' main uses and reasons for their preference.
2. MPT species characteristics that help to assess the extent to which they are suitable within principal ICRAF agroforestry practices. This will be done by recording in which farm niches/agroforestry practices trees are primarily found. This information will help to define suitability for proposed agroforestry practices.
3. Information on research opportunities for the different MPT species. This will be done by asking farmers about the problems that they face for each species and the opportunities they see for improvement.

Guidelines for Surveying

Timing of application in priority setting process. After the identification of user groups, researchers need to determine whether there is sufficient information available on farmers' MPT preferences. Where this information is lacking, farmer preference surveys need to be conducted.

Coverage. In theory the MPT survey should be representative of the entire region. In practice, the survey may be limited to areas where it is possible to mobilize a survey team. Within these areas, the MPT survey should cover the different (previously defined) user groups. Survey sites (e.g., village clusters or districts) should be selected so as to cover the main sources of variation in agroforestry systems in the area; possible sources include climate, ethnic group, or market access.

Time requirement. A survey team should be able to complete the MPT survey in ten days and analyze the results and write them up (in a few more days). For large areas (more than 15,000 km2) having greater variation, three weeks of field work with one week to write up should suffice.

Sample size. The MPT survey does not aim at collecting a data set for which tests of statistical inference can be applied. Rather it attempts to obtain reliable information on farmer preferences, species niches, and problems in as short a time as possible. For small- or medium-sized areas, 4 to 6 sites involving a minimum of 6 interviews per site should be sufficient. The interviews at each site should be spread across different villages. For larger areas, 8 to 10 sites would appear to be sufficient. Of course, the actual number of sites cannot be

defined solely on the basis of area — it should also be based on the variability in agroforestry systems. The greater the expected variation, the higher the number of sampling sites and sample size.

Nature and duration of the interview. Where possible group interviews, including 4 to 6 farmers, are preferred. Nevertheless group interviews may not be feasible under certain circumstances (cultural values, etc.). The scientist in charge of the survey will make a judgment on the most feasible approach depending on his/her local knowledge. Interviews will be held with a semi-structured questionnaire to enhance comparability of the data across farms and to help focus the interviews. At the same time the interviews should be informal. Typically, the question concerning preferred trees generates a discussion that may last twenty minutes. The interview should not take more than two hours and ideally be completed in one hour.

Composition of the survey team. Interviews should be conducted by a minimum of two people with different disciplinary backgrounds. Ideally the interview team should combine socioeconomic and biophysical disciplines. One person should lead the interview, while the other concentrates on taking notes.

Gender. It is important to balance the views and perspectives of both sexes in the MPT survey, because men and women may value different aspects and may be in charge of different species. The aim should be to spread the number of interviews per site equally among men and women. For this purpose it is recommended that female researchers be invited to participate in the survey. Interviewing males and females separately is probably preferable; in mixed interviews males tend to dominate.

Species coverage. Scientists need to decide beforehand which species should be excluded from the survey because they will not be considered by the MPT Improvement Program. For example, in HULWA, the following fruit/food species were excluded because they were being researched by other organizations: mango, papaya, citrus, coffee, cocoa, coconut, guava, kola nut, and oil palm. Most of these are exotics, but the two latter are local species. All other possible trees, shrubs, and woody vines should be considered.

Pretesting and training. The questionnaire needs to be tested and the participating researchers need to be trained in its use. These two tasks can be easily combined. Training and pre-testing should take about two days and may result in a substantial revision of the questionnaire. Revisions in guidelines should be written. It may be possible to include the pretest interviews in the overall analysis.

Sharing results. Efforts should be made to share the results of the survey with those who participate, including farmers and others (e.g., local leaders and extension agents) who may have assisted. A one-page, easy-to-read summary of the results should be drawn up and sent to all those who participated.

Guidelines for Interviewing

Many good references are available on how to conduct farmer interviews and surveys (e.g., Mettrick 1993). The most important advice for interviewers is to conduct oneself in a respectful and humble fashion. We interview farmers in order to learn from them. Thus our greetings, behavior, dress and interest in their concerns reflect our respect for them.

Before beginning the survey, pretest the questionnaire, that is, test the questionnaire to determine (a) whether interviewers agree on how the questions should be phrased, (b) whether changes in the format of the questionnaire need to be made, (c) whether there are sensitive questions that need perhaps to be omitted from the questionnaire or asked in a different manner. Pretests can be conducted with farmers living around the researchers' institute, or even with laborers at the researchers' institute with reference to their own farms.

Ask one question at a time. Do not confuse the interview by passing to a new question before the earlier one is concluded. It is best if only one member of the team takes notes, so that the others can focus their attention on interacting with the farmers. Always ask permission before taking notes.

In no case should farmers be given money for participating in an interview. This creates problems for extension agents and others who may come later to interview the farmers; they may not have the resources for paying farmers.

Cover page. Identification of site and farmers interviewed. Before meeting the farmers, write down the name of the village where the interview is held, the district, department or province, that it is in, and the country. If possible, the exact longitude and latitude should be obtained for georeferencing the data. Describe the principal land use system in the village (which major crops/enterprises) and the user group(s) being interviewed. If available, give information on the soil type and on the rainfall regime. In the case of a group interview, describe the group composition (number of male and female participants in the interview).

Introduction. Introduce yourself to the farmer(s). Explain what the objectives of the visit are: to obtain information and farmers' opinion about the species that it would be most useful to improve. We want to know this so that we can work on the best species, in order to bring improved trees to the area in the future.

Table 1: Species identification and ranking. Ask the farmer to list important species and record them in the first column. Obtain the names of the species by reviewing with the farmers the trees they are growing on the farm. Also ask the farmers about the species that they use from the forest or from the part of the farm that has not been cleared.

In the second column, write the vernacular name of the species. Note that there may be much confusion in recording vernacular names; several species may have the same or very similar names, or a single species may have different names depending on the variety.

In the third column, rank the most appreciated species from 1 through 10. The most preferred species is ranked number 1, the second most preferred number 2, and so on. Obtain these numbers by asking which species the farmers appreciate most. Help the farmer by

recalling the names of the species that he has given but not yet ranked. If more than ten species are mentioned, the extra species do not receive a number.

If two species tie in the farmer's preferences (e.g., two species are equally appreciated as the most attractive), give each one the average of the two positions that they would occupy in the rankings (if the two most appreciated species would be ranked numbers 1 and 2, they are each ranked 1.5).

Try ranking species using different methods. It may be best to ask farmers to first list the important species, and then go back and ask them to rank them. Or it may be best to ask them to list the three most important and then to focus on the next three most important.

The fourth column should be left open during the interview and be filled in only after the interview has been concluded. In this column, the numbers are changed to rank-order values. For this purpose, the species which obtained a 1 in column three obtains a 10 in column four, 2 becomes 9, 3 becomes 8, and so on.

In the fifth to seventh columns, write the codes for the criteria/attributes of farmer's preferences. If a non-coded criterion is mentioned, include a code for it which does not cause confusion with other codes. Write at the bottom of the page what the code stands for. If the criterion is a product, record the extent to which it is marketed (high, medium, or low relative to other species) and consumed at home (high, medium, or low relative to other species) The exact nature of the product (e.g., cotyledons used as additive to sauces to thicken them) should be written in the margin.

In the eighth to tenth columns, write the codes for the niches/production systems in which the species is found. If non-codified niches/agroforestry practices are mentioned, include a code for it, which does not cause confusion with other codes. Write at the bottom of the page what the code stands for.

Table 2: Identification of researchable issues by species. Write the scientific and/or vernacular name of the 10 most preferred species in the first column. Use the same order as in Table 1. Ask the farmers which problems they see in each species and what they would like to change in each one.

In the second to the fourth columns, put the improvement/research objectives mentioned by the farmer. These can be postcoded later (following the field survey) to facilitate analysis.

The fifth column provides space to document additional points that came up while discussing possibilities for improvement.

Conclusion. Please thank the farmer(s) for their attention, and for the useful information that they have provided. Inquire whether they have any questions in return. If so, please respond patiently before preparing to leave.

Farmer Preference Survey - Cover Page

Identification _____

Name(s) of interviewer(s) _____

Country _____

Land-use system _____

User group _____

Village _____

District/State _____

Farmer's name/group _____

No. of males in interview _____

No. of females in interview _____

Interesting notes/observations:

Annex 3, Table 1. Farmer Preference Survey

What are your preferred trees, shrubs, and woody vines?

1	2	3	4	5			6			7			8	9	10
				Attributes											
Name of species	Vernacular name	Rank 1-10	Rank-order values	A1	MA	HC	A2	MA	HC	A3	MA	HC		Niches	
1															
2															
3															
4															
5															
6															
7															
8															
9															
10															
11															
12															
13															
14															
15															

Codes

MA = Market/Cash (secondary/fallow)
HC = Home consumption
H = high, M = medium
L = low, 0 = none

Attributes

F1 = Firewood
MD = Medicine
FO = Food or fruit
T1 = Timber/Poles
CO = Compatible with crops
ST = Easy to store
LM = Low maintenance
EE = Ease of establishment

Niches

HG = Home garden
SF = Scattered in food crop
FV = Forest (virgin)
FS = Forest
BO = Boundary
ST = Scattered in tree crops

Annex 3, Table 2. Farmer Preference Survey

Improvement objectives (List species in same order as on previous page)

What would you most like improved about the species? (Answer only for the 10 most preferred species)

Name of species	Improvement objectives			Explanations
1	2	3	4	5
1				
2				
3				
4				
5				
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				

ANNEX 4: Table for Step 4: Ranking of Products

Products	A Present importance for farmers	B Future importance for farmers	C Improvement potential	D Total score: [(A+B)/2]xC
P 1	2	1	3	4.5
P 2				
P 3				
P 4				
P 5				
P 6				
P 7				
P 8				
P 9				
P 10				

Prioritizing among Products

Three criteria are used in prioritizing among products and are described in detail below. Each criterion is scored high (3), medium (2), or low (1).

Present Importance and Value for Farmers

The information about the relative importance of agroforestry products to farmers comes from reports in which user groups and farmers' problems and preferences are described. Importance/value is based on both farmers' views and researchers' views of farmers' problems and opportunities.

For example, concerning fodder, one could start by asking how important livestock is in the farming system and whether fodder is an important constraint in the area? Would farmers put a high value on increasing the supply/quality of fodder? Do researchers think that there is an important opportunity for increasing livestock production by increasing the supply/quality of fodder? In another example, farmers may not give much importance or value to curbing soil erosion but researchers may rate it of high value/importance to farmers, because they know that erosion is an important problem and that erosion control is required to sustain current levels of production in the area.

Future Importance and Value for Farmers

Here an extrapolation of the present situation to the future (about 15-20 years from now) is needed. Factors to take into consideration include urbanization, population growth, availability of improved technologies, etc. One would expect some differences between the present and the future ratings. For example, soil fertility may not be an important problem at

present but given population growth and current land-use practices, researchers may believe that it will be an important problem in the future.

Improvement Potential

Different MPT products have varying potential for improvement. For some products, e.g., fodder and fruit, there is a substantial knowledge base for improvement, whereas for other products, e.g., improving soil fertility, little is known. Here, researchers should also weigh the relative importance of tree improvement activities, as compared to management factors (e.g., spacing, cutting frequency), for increasing the value of the product. Information for this should come primarily from knowledgeable MPT researchers.

Total Score

In the calculation of the total score, ratings for present and future value are averaged, and multiplied by the rating for improvement potential:

Total score = [(A+B)/2] x C

Thus importance/value to farmers and improvement potential are given equal weighting in the calculation.

Researchers may wish to consider a fourth criterion, *Correspondence to agroforestry mandate*. It is important that the target product or service corresponds well to the mandate and the comparative advantage of the institutions involved in the improvement research. Thus, fruit research may receive a high rating on correspondence to mandate whereas medicinal research may receive a low rating, because the institutions involved may have less interest or comparative advantage in this area.

Additional criteria are added to the above formula as factors, i.e. [(A+B)/2]xCxDxE . . . .

ANNEX 5: Tables for Step 5: Identification of Priority Species

Annex 5, Table 1. Researchability Considerations

		Species 1		Species 2		Species 3	
	Weight	Value	Score	Value	Score	Value	Score
a. level of genetic variability	3	2	6				
b. germplasm availability	2	3	6				
c. knowledge base	2	1	2				
d. speed of reproduction	2	3	6				
e. potential for research breakthrough	4	3	12				
f. uniqueness of research efforts	1	3	3				
Total score			35				

In the first column, criteria are weighted from 1 to 5 according to their importance in contributing to researchability. Species are rated high (3), medium (2) or low (1) on each criterion. Values are multiplied by the weight to arrive at a score on each criterion. To arrive at total score, add the scores for all criteria.

Level of Genetic Variability

The greater the variability in the species, the easier it will be to achieve impact through improvement. The level of genetic variability includes different phenotypes/provenances and differences in fruit quality, growth rate, etc. among trees. For the region under consideration, prior to the exercise researchers should define how many phenotypes/provenances would indicate a high, medium or low performance for a species.

Germplasm Availability

The more germplasm is already available and the easier it is to collect, the greater and earlier the impact can be through improvement. This criterion includes factors such as (a) whether there have already been collections of germplasm (b); how easy it was to collect germplasm (legal issues); (c) whether the germplasm is storable (seed viability). If germplasm has not been collected, how easy was it to obtain (species morphology — thorny?), how often does the species flower, fruit, etc. For the region, researchers need to define which values indicate a high, medium or low ranking of the species, for example, number of accessions in gene bank if available, months/years of seed viability, flowering/fruiting frequency, etc.

Knowledge Base

The knowledge base includes all information already available on the species, including knowledge about sexuality, flowering/fruiting habits, pest and diseases and so on. A large knowledge base may indicate that results can quickly be obtained from improvement research. Indicators for the knowledge base include the number of articles about the species in libraries and the number of scientists working on it.

Speed of Reproduction

Opportunities for rapid improvement arise when a species has either a short sexual reproduction cycle (from seedling to fruit bearing), or if there are possibilities of shortcutting this by vegetative propagation or other technologies(e.g., grafting). Score the species by considering fruiting frequency and vegetative propagation success (rate of success, which supporting techniques are required, e.g., hormones).

Potential for Research Breakthrough

This criterion considers to what degree important characteristics exist that can be improved in the species, which would have an important impact on solving farmers' problems and contributing to their welfare. Possibilities include reducing the seasonality of fruit bearing, increasing fruit production and quality, reducing the size of the tree, and developing resistance against pests and diseases.

Uniqueness of Research Efforts

Other research groups may be already working on the same species, investigating similar questions. It is necessary to consider the risk of duplication and the potential for collaboration -u if the latter is high, the risk of duplication is low.

Annex 5, Table 2. Expected Adoption

		Species 1		Species 2		Species 3	
	Weight	Value	Score	Value	Score	Value	Score
a. ease of establishment	5	3	15				
b. short time to maturity	2	1	2				
c. pest/disease/weed resistance	3	3	9				
d. adaptability across region	3	4	12				
e. adaptability across socioeconomic groups	4	3	12				
f. compatibility with crops	1	1	1				
g. coppicing/pruning ability	3	2	6				
h. commercial potential	2	3	6				
I. value per unit labor and land	1	3	3				
j. production of planting material	4	1	4				
k. use in different agro-forestry practices/ niches on farm	5	2	10				
Total score			80				

Weight is very important (5), important (4), intermediary important (3), unimportant (2) or very unimportant (1); value is high (3), medium (2) or low (1); score is weight x value. To arrive at the final score, add the scores for all criteria.

Ease of Establishment

This covers propagation methods (i.e. is direct seeding possible, is a long time in nursery required?), whether the species can compete with weeds in seedling stage, whether special nursery conditions are required.

Short Time to Maturity

This includes information on how quickly the farmer would be able to harvest from the tree. Take into consideration the time needed to produce a useable/marketable product.

Pest / Disease / Weed Resistance

This criterion can best be addressed by listing serious pests, diseases and weeds and estimating the yield loss caused by them. Morphological characteristics could also be important, e.g., tannins that prevent pest attack, quick crown cover that might overshadow weeds, etc.

Adaptability across Region

To have a great impact on a large region, it is necessary to know how easily the species can be grown in different sites, soils and climates throughout the region.

Adaptability across Socioeconomic Groups

It is also of great importance that a species be acceptable across different income and gender groups, etc. Consider whether both males and females appreciate and have access to the products produced. Do both high-and low-income farmers plant the tree? Is the tree ac-

cepted among different ethnic groups in the region? Does it only have potential in areas with access to markets and urban areas?

Compatibility with Crops

If the species is to be planted alongside other crops, are there any adverse (or positive) effects known, how large is the number of key crops affected?

Coppicing / Pruning Ability

This criterion is only important for some technologies, i.e. hedgerow intercropping, live fencing, etc. Ask how good the coppicing ability is (survival after coppicing/pruning), how often can it be coppiced during a year/season?

Commercial Potential

This includes product storability and transportability, demand projection in the light of socioeconomic changes (e.g., rising urbanization, incomes etc.), and processing potential for industrial use. To value this criterion, questions have to be asked as to how long the product can be stored: are special methods required? Is it easily transportable? Do town dwellers prefer it more or less than country dwellers? Does consumption increase, stay the same or decrease as incomes rise? Can the products be exported?

Value per Unit Labor and Land

Compute this by dividing the value/tree by the area it takes up, and in a separate analysis by the labor used per tree/year.

Production of Planting Material

This will give information on how easy it will be to distribute enough seed/seedlings or vegetatively-produced cuttings to interested farmers. Take into consideration the number of viable seeds/tree/year, nursery techniques, whether vegetative propagation is possible and how high the success rates are.

Use in Different Production Systems/Niches on Farm

This will give an idea as to the degree to which improved material can be planted easily into the existing farm structure and if the species is flexible for use in different practices (e.g., home garden, boundary, improved fallows, etc.).

Annex 5, Table 3. Modifiers

		Species 1		Species 2		Species 3	
	Weight	Value	Score	Value	Score	Value	Score
a. gender	3	+10%	1.3				
b. equity	1	-10%	0.9				
c. contribution to conserving resource base	2	0%	1.0				
d. food security	3	0%	1.0				
e. regional spread	1	+10%	1.1				
total score			1.287				

The modifiers address additional issues, aside from increasing value, for which a tree might be chosen. To arrive at the total score for modifiers, multiply the individual scores for each criterion.

Gender

This addresses the question whether the tree/shrub will benefit one gender group particularly or both equally. The decision has to be made by the researchers whether they want to favor species which contribute to either or both gender groups. For example, researchers may decide to give a high value to a tree that benefits women in particular, or to one that benefits both sexes equally.

Equity

As above, researchers may give a high value to a species that is especially beneficial to, and appreciated by, low-income farmers.

Contribution to Conserving Resource Base

This addresses the role the species may play in soil erosion control, whether its use could take pressure off the natural forest (e.g., by providing fuelwood), and whether it can be used in watershed management. Has the species been identified as a keystone species, that is, earmarked in a list of internationally important species?

Food Security

Can the species play an important role in enhancing household food security by, for example, providing substitute food during the period of seasonal food deficit, or by being tolerant of harsh environmental conditions?

Regional Spread

Is the species important in a small part of the region only, or does it cover a major part — in the latter case there might be more people benefitting from improvement.

Add columns for more species as necessary.

Annex 5, Table 4. Calculating the Relative Gain Score (RGS)

Country/Area

Species	Researchability Score (A)	Adoption Score (B)	Modifier (C)	regulations (D)
				AxBxC
	35	80	1.287	3603.6

Note: Researchability, adoption and modifier scores are obtained from Annex 5, tables 1-3. The RGS is calculated by multiplying the scores in columns A, B and C.

ANNEX 6: Output of Step 6: Valuation and Ranking of Priority Species by Value (Step 6)

Annex 6, Table 1. Estimating the Value of Production per Tree Species per User Group

Area: _____

User group: _____

Number of users: 25,000 (A)

Species	Sample share of users growing and using the species	Average value of production among users			Total average value of production	Total value of production by user group
	(B)	Product 1 (C)	Product 2 (D)	...	(F)	(G)
					C + D + ...	B x F x A
	0.70	300	100	-	400	7,000,000

Annex 6,Table 2.
Total Value of Products of Tree Species per Year (US dollars)

Species	User group 1 Value of production (A)	User group 2 Value of production (B)	… … ...	Total value among sampled user groups (D)	Total population size/ Population size of sampled user groups (E)	Total value (F)
				A + B + ... + n		E x D
	7,000,000	3,000,000	-	10,000,000	1.25	12,500,000

Note: Values under A and B come from Annex 6, Table 1, column G. Column E is included to correct for the fact that certain user groups may not have been included, e.g., areas that have not been sampled or user groups in sampled areas that have been omitted. The assumption is that distribution of species among non-sampled groups is proportional to sampled groups. If this can be replaced by a more accurate assumption, this should be done.

ANNEX 7: Method for Step 6: Valuation and Ranking of Priority Species

The Multipurpose Tree Valuation Survey: Example from Nigeria

Questionnaire Objectives:
Farmer Questionnaire and Key Informant Questionnaire

General objectives

Estimate the value of genetic improvement research for selected multipurpose species.

Specific objectives

1. Value the products of selected MPT species to the household.
2. Determine how farmers manage the species, the problems they encounter, and the species growth characteristics.
3. Assess opportunities for, and farmer interest in, improving the species.
4. Assess the trends in production and potential demand for the increased production of these products.

Example of Multipurpose Tree Valuation Survey:
Farmer Questionnaire for Nigeria

Introduction

Explain to the farmer why you want to consult him/her:

- to know the importance of different multipurpose trees;
- to select the best species for improvement, in order that farmers may reap increased benefits in the future.

1. Interviewer

Country	**Ghana**	**Nigeria**	**Cameroon**
	1	**2**	**3**
Village			
District			
State			
Farmer name			
Gender of respondents	M _____	F _____	
Ethnic groupo			

Introduction

2. Do you have the following tree species?

			Number of trees				
Scientific name	**Local name**	**yes/no**	**Home garden**	**Tree crops**	**Food crops**	**Fallow land**	**Virgin forest**
Irvingia Gab v. Gab			**Fr**				
			Ju				
Irvingia Gab v. excelsa			**Fr**				
			Ju				
Dacroydes edulis			**Fr**				
			Ju				
Chrysophyllum albidum			**Fr**				
			Ju				
Rhicinodendron heudelotii			**Fr**				
			Ju				
Garcinia kola/ afzelji			**Fr**				
			Ju				

Growth and management characteristics

3. Do you plant this tree or do you protect it when it comes up?

	I.G. gabon.	*I.G. excel.*	*D. edulis*	*C. albidum*	*R. heud.*	*G. cola*
Transplant wildings	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Retain or protect	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Plant seeds	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Plant seedlings	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO

If farmer does not plant/transplant, go to Q.6.

4. If plant/transplant, where do you obtain planting material?

	I.G. gabon.	*I.G. excel.*	*D. edulis*	*C. albidum*	*R. heud.*	*G. cola*
Main source						
Second source						
Third source						

Code: 1. Own farm, any tree
2. Own farm, selected tree
3. Own farm, selected fruit
4. Neighbors/relatives
5. Nurseries
6. Market place

5. If farmer plants/transplants, how do you select the tree/fruit?

Find out farmer's selection criteria (if possible, rank criteria farmer states by putting in a number. Do not suggest criteria.).

	I.G. gabon.	*I.G. excel.*	*D. edulis*	*C. albidum*	*R. heud.*	*G. cola*
Tree: many fruits						
Tree: early maturity						
Tree: produce every year						
Fruit: less fibrous						
Fruit: increased sweetness						
Fruit: large size						
Seed: increased availability						
Seed: increased bitterness						
Other						
Other						

Code: 1 = top ranked, etc.

6. Are there pests and diseases that severely affect production?

	I.G. gabon	***I.G. excel***	***D. edulis***	***C. albidum***	***R. heud.***	***G. cola***
Pests and diseases	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Main pest / Disease #1	.....	.....	.....	.....	.....	.....
Part attacked	F L R	F L R	F L R	F L R	F L R	F L R
Control measure	.....	.....	.....	.....	.....	.....
Main pest / Disease #2	.....	.....	.....	.....	.....	.....
Part attacked	F L R	F L R	F L R	F L R	F L R	F L R
Control measure	.....	.....	.....	.....	.....	.....

Code: F = Fruit R = Root O = Other L = Leaf B = Bark

7. What tasks do you carry out for this species?

Type of task	***I.G. gabon.***	***I.G. excel.***	***D. edulis***	***C. albidum***	***R. heud.***	***G. cola***
Manuring	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Pruning/ Coppicing	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Weeding	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Main harvest method	climb gather	climb gather	climb gather	climb gather	climb gather	climb gather
Processing	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Other, Nature of work	.....	.....	.....	.....	.....	.....

Uses

8. Does the tree have medicinal use?

	I.G. gabon.	***I.G. excel.***	***D. edulis***	***C. albidum***	***R. heud.***	***G. cola***
Medical use	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Ailment 1 (write in)						
No. times over the last year used by family or given to others						
Tree part (circle)	Bark Root Leaves Fruit Seed	Bark Root Leaves Fruit Seed	Bark Root Leaves Fruit Seed	Bark Root Leaves Fruit Seed	Bark Root Leaves Fruit Seed	Bark Root Leaves Fruit Seed
Sold during past year	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
If sold, how many times in past year?						
Price/sale						
Total revenue						

Ailment 2 (write in)						
No. times over the last year used by family or given to others						
Tree part (circle)	Bark Root Leaves Fruit Seed	Bark Root Leaves Fruit Seed	Bark Root Leaves Fruit Seed	Bark Root Leaves Fruit Seed	Bark Root Leaves Fruit Seed	Bark Root Leaves Fruit Seed
Sold during past year	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
If sold, how many times in past year?						
Price/sale						
Total revenue						

9. In what other ways do you use this tree and its parts (fruits, bark, roots, leaves, etc.)?

	I.G. gabon.	***I.G. excel.***	***D. edulis***	***C. albidum***	***R. heud.***	***G. cola***
Firewood?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Sold?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Times used in last two years						
Timber?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Sold?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Times used in last two years						
Poles?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Sold?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Times used in last two years						
Stakes?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Sold?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Times used in last two years						
Fodder?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Times used in last two years	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Carving?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Sold?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Times used in last two years						
Other?	.....	.....	.....	.....	.....	.....
Sold?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Times used in last two years						
Other?	.....	.....	.....	.....	.....	.....
Sold?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Times used in last two years						

10. Does the tree have any effect on the yield of tree or food crops around it?

	I.G. gabon.	*I.G. excel.*	*D. edulis*	*C. albidum*	*R. heud.*	*G. cola*
Effect on tree crops	+ 0 -	+ 0 -	+ 0 -	+ 0 -	+ 0 -	+ 0 -
Reason						
Effect on food crops	+ 0 -	+ 0 -	+ 0 -	+ 0 -	+ 0 -	+ 0 -
Reason						

Codes for effect: + = positive
0 = no or mixed effect
- = negative effect.

Codes for reasons: Sh = Competes for light
Com = Competes for nutrients
Lea = Leaves add fertility

11. What is the age of the tree at first fruiting?

	I.G. gabon.	*I.G. excel.*	*D. edulis*	*C. albidum*	*R. heud.*	*G. cola*
Age at first fruiting						

12. Estimate production and value of the fruit:

If farmer collects from forest and produces from own farm, ask total for each.

	I.G. gabon.	***I.G. excel.***	***D. edulis***	***C. albidum***	***R. heud.***	***G. cola***
Collects from forest	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
Last year: Quantity produced/ collected (units)						
Two years ago: Quantity produced/ collected (units)						
Quantity *sold* last year (units)						
Price/unit						
Quantity consumed last year (units) or % of prod.						
Good year: quantity produced/ collected (units)						
Bad year: Quantity produced/ collected (units)						

Local measure conversions:

If farmer sells fruit and knows Q/*tree sold*:

No. trees x baskets/tree x value/basket = value of sales
Value of sales / (1 - % cons.) = total value of production

If farmer knows Q/*tree produced:*

No. trees x baskets/tree x value/basket = value of production

13. Marketing:

	I.G. gabon. **fruits**	***I.G. excel.*** **seed**	***D. edulis***	***C. albidum***	***R. heud.***	***G. cola***
If sold, where did you sell last season?						
Distance to market						
Price/unit beginning of season						
Price/unit middle of season						
Price/unit end of season						
Sold wholesale or retail?	W R	W R	W R	W R	W R	W R

GO BACK TO PAGE ONE OF THE SURVEY AND BEGIN A NEW SPECIES.

14. If we came with improved species of the trees we talked about today, which one would you like to plant?

(Choose one)

	I.G. gabon.	***I.G. excel.***	***D. edulis***	***C. albidum***	***R. heud.***	***G. cola af:.***
Rank						

Example of Key Informant Questionnaire: Production, Nigeria

Name and occupation of informant:_____

Area that informant is referring to:_____

Growth and production

	I.G. gabon.	***I.G. excel.***	***D. edulis***	***C. albidum***	***R. heud.***	***G. cola afz.***
Does mature tree bear fruit every year?	YES NO	YES NO	YES NO	YES NO	YES NO	YES NO
How many fruiting seasons/year?						
Months 1st season						
Months 2nd season						
Quantities from *forest* increasing or decreasing?						
Quantities from *farms* increasing or decreasing?						
For tree on own farm, who has right to harvest?						

Code: Right to harvest/collect: 1 = family member
2 = strangers with my permission
3 = strangers without my permission
4 = anyone who wants to satisfy their hunger

Gender roles and processing

	I.G. gabon.	*I.G. excel.*	*D. edulis*	*C. albidum*	*R. heud.*	*G. cola afz.*
Who harvests the trees?	M F C	M F C	M F C	M F C	M F C	M F C
Who processes?	M F C	M F C	M F C	M F C	M F C	M F C
Who receives the cash?	M F C	M F C	M F C	M F C	M F C	M F C
Detail the different processing methods						
For each processing method, how long can product be stored?						

Code: M = male
F = female
C = children

Explanatory Notes with Farmer Questionnaire for Nigeria

Question 1. Interviewer's name and location of the interview should be filled in before the interviewer meets the farmer. Do not waste time filling these in the presence of the farmer.

Question 2. Local names should be inserted before the interview. Begin by first finding out which species the farmer has. Go down the list of six species/varieties marking yes or no. Finding out first how many of the species he has will help you to pace yourself during the interview. For example, if he only has one of them, you can proceed slowly.

Begin with the first species and ask all questions relating to the species (e.g., questions 1-13). Then go back and begin the second species.

The first species to discuss is not necessarily Irvingia gabonensis. Rather, randomize the first species by marking a different species as first species on each questionnaire. Thus I.G. gabonensis can be first on the first questionnaire, I.G. excelsa can be first on the second questionnaire, etc. Since we know that information will be most detailed and accurate for the first species we discussed, it is important to change the species we begin with.

Tree numbers are broken down by niche in order to help the farmer count his species. This also gives us valuable information on niche.

If the farmer does not know how many trees he has, put 'a' ? If he has no trees in a given niche, fill in 0.

In counting trees, ask the farmer to differentiate between trees bearing fruit, and juvenile trees. If he has a very large or very small number of juvenile trees relative to fruiting trees, ask why.

In some case farmers also 'have' trees in the virgin forest. For example, in some areas, farmers pay the chief in order to have the right to harvest specified trees in the virgin forest. In this case, fill in the number under 'virgin forest'. In other (the majority of) cases, farmers

collect from the forest any trees they come across. If this is the case, fill '0' here since they are not the farmers' trees. We will deal with the collection from the forest in question 12.

Question 3. Farmers may practice more than one of the methods of planting or retaining naturally regenerated wildings. Circle the 'Y' next to the method(s) the farmer uses.

Question 4. Only answer if he plants or transplants. Differentiate between selecting a tree (any fruit from the tree) or selecting a fruit (one with certain qualities, e.g., taste). Of course, farmers may select both tree and fruit for planting.

Question 5. Only answer if he plants or transplants. He will probably have already given the answer to this question in question 4. Do not suggest any answers from the list, simply write in the selection criteria the farmer gives. Assume that the firs criterion he mentions is the main one, the second one is the second, etc.

If farmer selects for taste, ask specifically what this means.

Question 6. It is not necessary to ask about pests and diseases of Irvingia in Nigeria, information is readily available.

Only record pests and disease that severely damage production. When the farmer mentions a pest or disease, ask whether it causes severe damage, if it doesn't, ask about other pests and diseases or go to the next question.

Fill in a maximum of two pests/diseases per species.

Question 7. Circle yes or no for the tasks carried out on each species. Circle yes even if the practice is only done for some of the farmer's trees, e.g., circle yes for weeding even if he only weeds the juvenile trees.

Manuring includes fertilizer. Trees in home gardens may benefit from the application of household refuse and manure. Mark 'yes' only if the manure is deliberately applied to the trees.

For harvesting, circle yes next to the main harvest method. Gathering from the ground is a method of harvest for nearly all fruit trees — in this question we ask whether it is the main method or if most fruits are harvested by climbing and removing.

Processing — includes processing done by the farmer or his family. Note other processing activities done off the farm in the key informant questionnaire under processing.

Question 8. Do only two ailments per species. Make sure that the treatment is really an important means of treating the ailment; if it is not, then omit it. The issue here is not to detail all the possible uses of the tree, but rather to describe the ones the household actually uses. For example, one farmer provided details about the use of Dacyodes leaves for treating fever. But when it came to asking when was the last time she used it, she stated that there were actually other species that were more effective, so she did not use it. There is thus no reason to include it in the questionnaire. The lesson is that you should quickly get to the question "no. of times over the last year used by family or given" to ascertain the importance of the species.

Some uses may be important even though they have not been used in the last year. For example, the leaves of Irvingia are an important ingredient in the remedy for underweight babies. Even though the household has not used it during the last year, it is important to note this use.

Circle more than one tree part if more than one is used.

Question 9. Again the issue here is to detail the actual uses by the household, not the possible uses. So, under fodder, let us say that a farmer says that the fruits can be eaten by animals, but being too valuable, they are not fed to them. In this case, 'N' is circled under fodder.

Timber refers to sawn logs. Poles refers to round, whole trees or branches used for construction or supports.

Carving refers to wood used for carving household utensils, musical instruments, etc.

Question 10. The point is to assess the impact of the tree on the crops around it. Therefore, a farmer has misunderstood the question if he answers, "it has little effect because I have so few trees in the field". Rather, he should be guided to assess the impact of a single tree on the crops surrounding it.

Question 11. Estimating fruit production and value is the most difficult part of the questionnaire. It requires considerable tact, as well as cross-checking. We should focus on the last year of production (in most cases, this applies to a single season): the quantity produced, sold, and consumed, and the price of quantities sold. In addition, we should ask about the production two years ago and how production varies between good and bad years.

By the end of the page, you should be able to calculate the value of fruit produced. You do not have to go though all the calculations, this wastes the farmer's time, but be sure you have all the components you need. Calculate the total value of production shortly after completing the interview. Do your calculations on the questionnaire, carefully labeling all values so that your figure can be checked later.

Scenarios for determining value of production

Several different scenarios for determining value of production have come up in pretesting:

Case study no. 1. In Nigeria a farmer was able to estimate the average number of baskets of Chrysophyllum albidum fruits sold per tree. He also knew the price he received per basket. We multiply the number of trees times the number of baskets/tree times the price per basket and arrive at the value of the produce sold. He could not estimate the quantity his family consumed, but he was able to estimate the percentage of the total production consumed. We divide the value of sales by 100 - % to arrive at total value of production. The formulas are shown below.

If he sells fruit and knows Q/tree sold:

	No. trees		baskets/tree		Naira/basket		Value of sales
Example:	37	x	30	x	40	=	44,400

	Share of home consumption		Share of sales
Example:	0.25	→	0.75

	Value of Sales		Share of sales		Total value of production
Example:	44,400	/	0.75	=	59,200

Note that we value fruit sold at the same price as fruit consumed.

Case study no. 2. A second Nigerian farmer knew the quantity of Irvingia gabonensis fruits she produced per tree in baskets. We obtained the price per basket she received. These give us the total value of production. The quantities sold and consumed can be obtained by asking the relative proportions or absolute quantities. The formula for computing value of production is.

If she knows Q/tree produced:

No. trees		baskets/tree		Naira/basket		Value of sales
5	x	6	x	150	=	4,500

If she knows values/tree sold:

No. trees		Naira/basket		Value of sales
4	x	100	=	400

Case study no. 3. A Cameroonian farmer knew the total quantity of Dacryodes edulis fruits he had sold and the total amount of money he received. In contrast to the Nigerian farmers above, he had no idea how much fruit a single tree produced. He did not know how much his family consumed, but he was able to estimate the proportion. We used the formula in Case study no.1 above to arrive at a total value of production.

Case study no. 4. In Nigeria, some farmers sell their fruit to middlemen who actually harvest the tree themselves. The farmers told us the money they received for allowing the middlemen to harvest the fruits. They were also able to estimate the quantities they consumed themselves before and after the middlemen harvested. We thus used the formula in Case study no.1 to calculate total value of production.

Several methods should be used to cross-check the data. For example:

- Quantity consumed + quantity sold = quantity produced

- Quantity produced over the last year should be within the range of production in good and bad years.
- The price received should be between the highest and lowest price of the season, recorded in question 13.

Other important points:

- Do your best to estimate the quantity in kg of local measures. Where these are standard, we can try to weigh the quantity they hold. Try to buy some of these containers for this purpose, either from farmers or in the market.
- ·Do not forget to write in the units (e.g., baskets, bags, or other local measures) in each box. At the bottom of the page, estimate the weight of the local measure.
- If the farmer is estimating the average quantity of fruit per mature tree over the last year, the estimate should include mature trees that did not happen to bear fruit over the last year.
- Quantities given away should be included in the quantities consumed.

Question 12. If sold on farm, state whether middlemen harvested or farmer harvested. Season refers to the period his/her trees were in production. Wholesale means s/he sold his/her fruit in bulk. Retail means s/he sold in small quantities to many buyers.

Question 13. The final question sums up overall farmer preferences for planting the mentioned species. Let the farmer choose one (if any!).

Closing

In closing, thank the farmer and explain again how useful his/her information is for helping us to plan our research. Ask if s/he has any questions you can answer.

ANNEX 8: Final Output (Step 7)

Developing an Indicator of Relative Priority

Species	Value of species (millions of USD) (A)	Researchability (B)	Expected adoption (C)	Modifiers (D)	Indicator of relative priority (AxBxCxD)
	12.5	35	80	1.287	45045

Notes:

- B, C and D are obtained from step 6. If the valuation survey in step 6 has not brought any modifications to the assignments done in step 5, the results from step 5 (Annex 5, Tables 1 and 3) can be used.
- A is obtained from step 6, as calculated in Annex 6, Table 2.
- The higher the indicator of relative priority, the better the research opportunities. The indicator has no absolute meaning, only a relative one.
- If quantitative data are not obtainable, ordinal data may be substituted (see Box 3.9).

Covers: Chlorine-free paper
Inside pages: Recycled paper

Produced by ISNAR Publications Services

Text editor: Judy Kahn
Printer: Rapporten Service Drukkerij B.V., Rijswijk, The Netherlands

ISSN 1021-4429
ISBN 92 9118 025 4

International Service for National Agricultural Research

Headquarters

Laan van Nieuw Oost Indië 133, 2593 BM The Hague, The Netherlands

Correspondence

P.O. Box 93375, 2509 AJ The Hague, The Netherlands

Communications

Tel: (31) (70) 349-6100, Fax: (31) (70) 381-9677, Telex: 33746, Email: Internet ISNAR@CGNET.COM